

# MODEL UNDERSTANDING AILERONS **AIRPLANE**

THE WORLD'S PREMIER R/C MODELING MAGAZINE



48120

## NEWS

June 1995

## ENGINE & ACCESSORY BUYERS' GUIDE



**BYRON EXTRA 300S**



## HOW TO DESIGN A STREAMLINED COWL

CONSTRUCTION:  
1/4-SCALE SWICK  
TAYLORCRAFT

## 10 TOP MODELING TRICKS



## QSAA GIANT-SCALE FLY-IN

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**REVIEWED THIS ISSUE:**

- TSi .40 2-STROKE GLOW ENGINE
- LANIER STINGER 40
- GLOBAL RAVEN 60



# MODEL AIRPLANE NEWS

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**ABOVE:** Byron's new 1/5-scale Extra 300s during a low-speed flyby. Contributing author Mike Lee captured the moment on film. Check out Mike's review of this authentic .90- to 1.20-size model of the aerobatic champion.

**ON THE COVER:** Dean Lassek brings home his spectacular A-10 Warthog after a successful "mission" during the QSAA International Giant Scale Fly-In. This 46-pound model flew nicely with twin O.S. .91 DF engines spinning Dynamax fans. Full coverage of this event starts on page 56 (photo by Nick Zirolì Sr.). Also on the cover (clockwise from top): Byron's Extra 300s (photo by Mike Lee); 'A-scale Swick Taylorcraft (photo by James Simpson); Nick Rivaldo's B-25 from the QSAA (photo by Nick Zirolì Sr.).

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## SIMPLIFYING THE SUBLIME

The pace of change in electric flight has accelerated with the arrival of new motors and the proliferation of gear- and belt-reduction drives. Model

Add to this the promise of soon-to-be-available, higher-pitch, folding propellers (well-suited to electric motors, which offer high torque

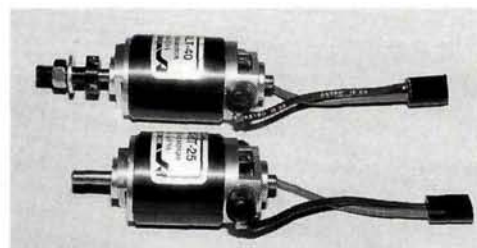
from low to high rpm). With so many options to choose from, how is one to match motor, prop, gear/belt reduction drive and airplane?



*Hobby Lobby notes that the new Mega R5 (5-turn, 10 to 14 cells) and R7 (7-turn, 10 to 16 cells) neodym motors have provided 10-minute aerobic flights (switching the motor on and off). What size prop and gearbox, if any, would you want to use?*

Electronics, for example, now offers 70 gear ratios in its new Super Box gearbox (see Tom Hunt's review, May '95). A host of gear- and belt-reduction systems is now distributed by Hobby Lobby.

Sophisticated, easy-to-use tools exist for this in the form of software, e.g., AERO\*COMP (by USR&D Corp., [908] 850-4131) and Electro Flight Design (by Kress Jets, [914] 336-8149);



*Astro Flight's new 5-turn FAI 25 and FAI 40 motors, available in direct-drive and geared versions, provide sufficient power on 10 Ni-Cd cells to repeatedly yank an airplane up several hundred feet in a nearly vertical ascent (see Tom Hunt's motor review in our October '94 issue).*

but the quest here is for a simple, reasonably accurate and reliable method that any modeler can use when choosing an initial setup. Hobby Lobby has faced this puzzle head on and formulated the rules noted in the box on this page. Can you punch a hole in this approach and

### How to Choose *sat* Electric Motor, Prop and Reduction System

As with glow engines, experimentation is necessary. The following will get you close.

#### 1. Choose the electric motor.

50 to 60 watts per pound of airplane weight.

or...

Gives thrust greater than 1/3 the airplane's weight.

#### 2. Choose prop pitch.

$Pitch = \text{air Speed in mph} \times 1,805 \text{ rpm}$

• **Air speed in mph.** Decide how fast you want to fly. Most RC airplanes fly at between 30 and 60mph. If you want to pitch the prop for a 30mph climb and then fold the prop for glide, put 30 here. If you want a 50mph cruise speed with the capability to achieve a higher top speed, put 50 here.

• **Rpm.** Decide how fast you will run your motor. If you have an on/off motor control, put the free-shaft rpm (i.e., "no-load" rpm) of the motor here. If you have a proportional speed control and want to cruise at % throttle, reserving full

throttle for added power, put 2/3 of the free-shaft rpm of the motor here.

Note: if the pitch suggested by this formula is too low and there are no props available in this pitch, you'll need a gear- or belt-reduction system to make the rpm number lower. See no. 4 below.

#### 3. Choose prop diameter.

Motor (watts)	Diameter (inches)
10 to 50	5 to 6
50 to 100	7 to 8
100 to 150	8 to 9
150 to 200	9 to 10
200 to 300	10 to 12
300 to 400	12 to 14
More than 400	Select a diameter that will give about 1/2 of the free-shaft rpm

If you use a reduction system, multiply the diameters found at left by (.75 x gear ratio).

#### 4. Choose a reduction ratio.

$\text{Reduction ratio} = \frac{\text{rpm of motor} \times \text{prop pitch}}{\text{air speed in mph} \times 1,805}$



*New internally driven gear drives (Intro-Gear 400) offered by Hobby Lobby preserve motor efficiency and simplify matters because they don't require reversal of the motor with attendant re-timing issues. This is one of many gear-reduction options now available.*

improve it?—with roughly the same or fewer words? If you can, you'll make a valuable contribution—one we would like to share with the rest of the world. Send your ideas to the attention of Debra Sharp, c/o *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897; fax (203) 762-9803; Internet address: [debs@airage.com](mailto:debs@airage.com). A diverse panel of experts will review suggested alternatives; we will publish the most promising, and we'll award the author(s) a free, two-year subscription to *Model Airplane News*.



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# AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," Model Airplane News, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

## BRIGHT AS A LASER

I'm very interested in computers and high-tech manufacturing technologies. I hope one day to start a hobby-related business using CAD programs to design parts and, eventually, to sell these parts as aftermarket items for modelers. I've been seeing more and more mention of lasers being used to cut out wooden parts for model airplane kits. Where parts have traditionally been cut out using steel die-cutters, computer-controlled lasers are now producing highly accurate, and often very intricate parts. What's involved in this new technology? Do any companies make 100-percent-laser-cut kits, and do you think laser cutters or water cutters will spell the end for traditionally manufactured kits?

JOHN HIDY  
South Bend, IN

*John, with the power of today's computers and the sophisticated programs available to design model parts, it's easier than ever before to produce highly accurate parts whether they're of wood, plastic, carbon fiber, or metal. Lasers and water-jet cutters have been around for many years in industrial manufacturing, and they entered the R/C marketplace about five years ago.*

*The lasers used to cut balsa are typically CO<sub>2</sub> lasers that produce an invisible, infrared light beam. The beam is approximately 3mm in diameter and is focused into a 0.005-diameter cutting beam by a lens that's just above the surface of the wood. All that's visible is a little smoke and a bright spot where the wood is being cut (burned!). For thick pieces of wood (1/4 inch), several laser passes are required to minimize the charring of the finished part.*

*Water-jet cutters use an extremely fine stream of highly pressurized, purified water to cut materials. The water is typically only a few tenths of*

*a thousandth of an inch in diameter and is pressurized at anywhere from 3,000psi (to cut cardboard and thin wood) to 50,000psi and more (for high-speed production and metal cutting). The water is first pressurized through intensifier units (huge, high-pressure pumps that also filter and purify the water); then it's piped to the cutting aims that contain cutting jewels (small disks of industrial diamond) that have a tiny hole in them. The water passes through the small hole, hits and cuts the raw material and is then collected underneath (along with waste production material) in receiver funnels; then it's returned to the intensifiers to be recycled.*

*The actual cutting is controlled by computer programs—much in the same way as a pen is controlled in a pen plotter that draws plans. Instead of a pen, however, the cutting unit moves and cuts the part rather than drawing it. The real breakthrough in using this relatively new production technology is that waste is minimized, and designers can use actual production parts when they assemble their prototype models. Corrections to these prototype models can be made quickly (on the computer), and the new replacement part can be produced in minutes. Parts may be easily altered, and the effects they have on an entire model are instantly seen when the prototype model is made.*

*Companies such as Byron Originals, Airtronics, Midwest Products Inc. and Sig Mfg. Inc. now include laser-cut parts in their kits (to the joy of model builders around the world). To the best of our knowledge, the only one manufacturing a completely laser-cut kit is a new company: Heir Engineering Co., 5648 Kingman Ave., Portage, IN 46368; (219) 759-1940. Owner Tom Hen produces small, scale, rubber-powered airplane kits and, judging by*



the kits we've seen, he makes a very impressive, high-quality product. You have to see one of his kits to appreciate just what a laser can do.

Will laser or fluid cutters end traditional production of model kits? I say no. These new cutting systems are great advances, to be sure, but most manufacturers would agree that, unless you have good reason, making something with an expensive laser instead of a band saw or a die-cutting machine may not make good business sense. I think you'll see lasers and fluid cutters used where other, more traditional, cutting methods don't work as well. GY

#### SPEAKING THE LANGUAGE

I'm very interested in electric flight, and I enjoyed recent *Model Airplane News* columns and articles on this subject by Keith Shaw, Mitch Poling and Tom Hunt. However, I'm not familiar with many of the terms that are used to describe the performance and workings of motors and power systems. Do you know of any reference material or previously published articles that may help me?

JOE NEWTON  
Warrensburg, MO

Joe, Paul Ogushwit: of USR&D Corp.—publishers of AERO\*COMP software—recommends "DC Motors, Speed Controls, and Servo Systems Engineering Handbook," (third edition, 1975, Electro-Craft Corp.). For more information, write to 1600 Second St. S., Hopkins, MN 55343, or call (612) 935-8226.

Paul says, "From the physics point of view, we consider this to be the best book on the subject of DC electric motors. It contains the starting point for the theory we developed for our AERO\*COMP software. The book would be comprehensible to anyone with a solid understanding of undergraduate (college) physics." TA •

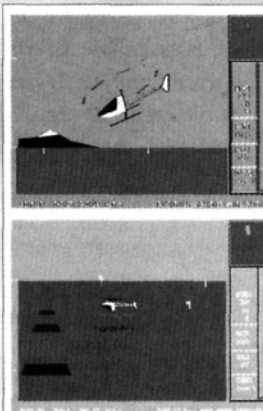
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HOW TO

# 10 secrets of a master modeler

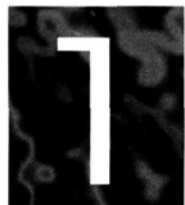
## Tricks of the Trade

by BOB FIORENZE

THE OPPORTUNITY to exchange ideas with fellow modelers is one of the things that is enjoyable about our hobby. Each day at my hobby store, I receive many phone calls from people who have questions on a variety of subjects. The following article covers several topics that I have received questions about as well as some additional information that you should find useful.

*Editor's note: to anyone who follows ducted-fan activity, the name Bob Fiorenze is synonymous with state-of-the-art models and superb flying. His "swing-wing" F-14 Tomcat and more recent F-117A Stealth bomber, both Yellow Aircraft\* kits, are sure show-stealers at any fan-fix. During his 31-year modeling career, Bob has won such notable events as the Scale Masters, Top Gun and the AMA nationals. He has been asked by the*

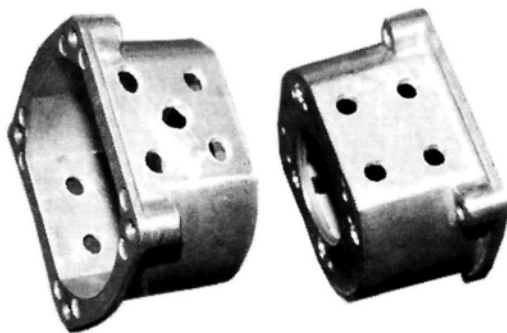
*AMA to evaluate turbine engines and, currently, he is working closely with Yellow Aircraft to develop new products. In addition to jets, Bob has an avid interest in other types of aeromodelling—mainly warbirds and scale helicopters. In this article, he shares some of the innumerable modeling tricks and tips that he has picked up over the years. Some apply to ducted-fan models; others are more general in application.*



### Modified Gas-Engine Mounts

For the past year, I've been flying gasoline-powered airplanes. It came to my attention that during operation, a significant amount of heat is transferred to the metal engine mounts. Because the engine mounts are acting as heat sinks, the cooling efficiency can be increased by drilling several holes in the mount (metal cools more effectively around its edges). Owing to the way heat is transferred, it probably wouldn't hurt to drill more holes in the top than in the bottom. The photo shows the modified mounts from my P-38 Lightning with four holes in the bottom and five holes in the top.

An engine that runs cool will usually last longer than an engine that runs hot!

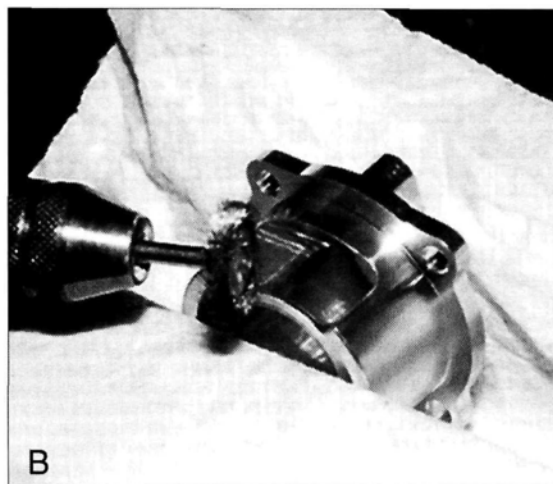
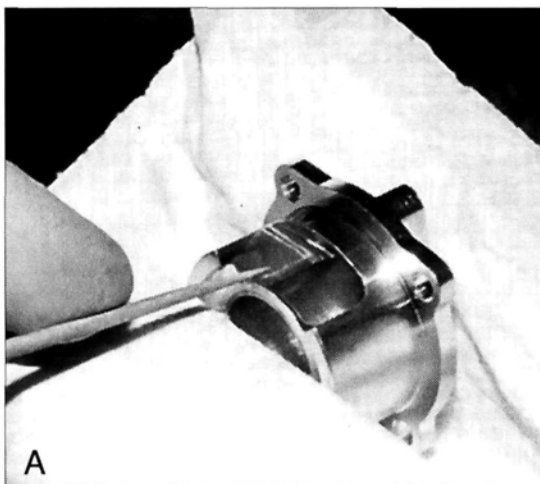


### Longer Prop Bolt

When you use a spinner, the longer of the two bolts in the photograph should be used to secure your propeller. The spinner-backplate thickness may not allow the shorter bolt to hold the prop securely. The longer bolt is available from B&B Specialties\*.



# 3

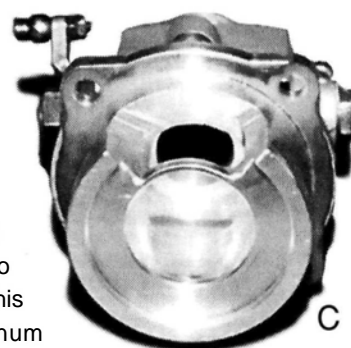


## O.S. .91 Rotor Housing Mod

The thin, curved aluminum bridge in the rotor housing assembly of an O.S.\* 91 ducted-fan engine will become fatigued over time. I've had this happen with engines that have been used in 50 or more flights. To avoid this problem, place the housing in a vise and, using a Dremel tool, file a radius on the inside corners of the thin aluminum to reduce stress in this area (see photo A). A round file from K&S\* file set no. 430 also works well. Be sure to avoid filing too deeply. Filing a radius helps prevent a crack from forming. By doing this, your engine will not ingest aluminum from an operational failure. To protect the housing, put paper towels or a thin rag against the vise jaws, and secure it with tape so that it won't get caught in the Dremel. Be careful when you're filing; the object is to eliminate the sharp corners and preserve the center aluminum section. After rounding the corners, insert a wire-wheel attachment into your Dremel, and polish the area (see photo B). Be sure to clean up all the debris before reassembling.

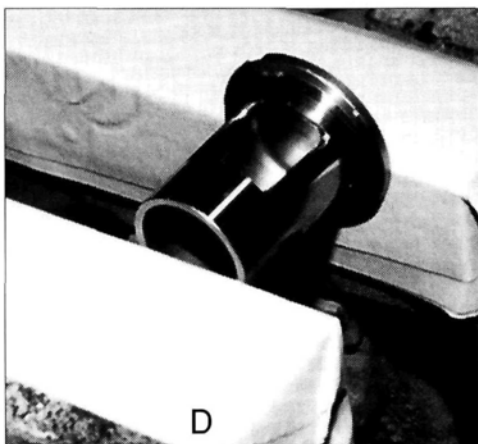
If this area on the rotor housing has already developed cracks, all is not lost. An alternative modification will also work. In photo C,

the cracked aluminum piece has been removed. The first step is to file the inside corners as previously discussed. File the aluminum until you reach the surface of the brass insert. Be careful not to damage this surface. At this point, the center aluminum section of the bridge can be easily removed. Using a small wire wheel in your Dremel, carefully



polish the area. The polishing helps to remove small metal fragments. Be sure to remove all debris before reassembling.

While the rotor assembly is apart, you can inspect the rotor. I've noticed traces of wear on some rotors that roughly coincide with the area that becomes fatigued on the housing (see photo D). Using a small, conical grinding stone in a Dremel, you can radius the sharp inside corners. This is called stress relieving. *[Editor's note: Bob works closely with O.S. and has relayed this problem and solution to them. Stress relieving of this area has been done on all new production runs of this engine.]*



## Low-Cost Masking

This photograph shows the masking on my F-18 Hornet. To reduce cost during painting, I only use masking tape and paper for definite lines. For all other areas, I use old sheets or blankets to protect areas from overspray. Make sure that the blankets don't have any holes in them, or you'll be switching to a spotted camouflage scheme.

# 4

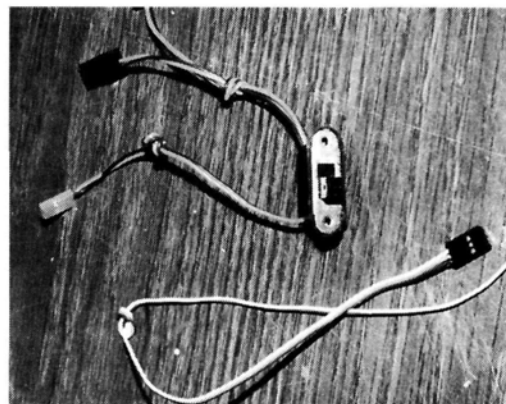


# 5

The exhaust headers on ducted-fan engines are often overlooked when it comes to leaks because the engine is not usually visible. If the dirty mess caused by the leak bothers you, try putting some high-temperature silicone RTV on the header. Allow the RTV to "skin" before assembly.



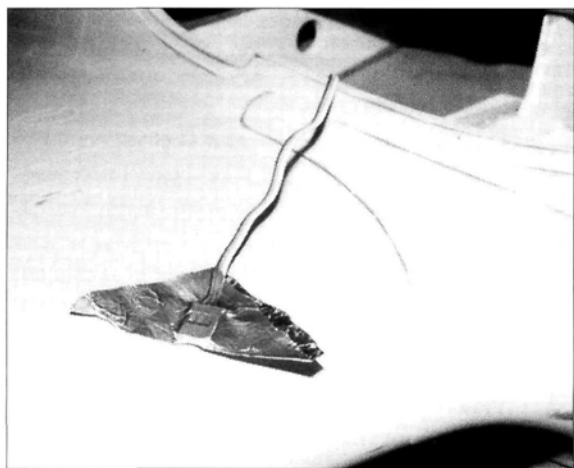
## Stop Exhaust Headers Leaking



## Marking Questionable Radio Gear

If you're wondering about the integrity of your radio gear's wiring after a crash or undue stress, don't just throw the gear into a pile. First, tie a knot in the lead wire so that you don't accidentally use it for a critical flight control like elevator or ailerons.

# 6



## Protecting Radio Lead Plugs

While you're working on your airplane, cover the radio lead plugs with small pieces of aluminum foil instead of masking tape. You can be more certain of a clean connection this way and, unlike with masking tape, there's no sticky residue left when you remove the foil. You'll be amazed at how dirty the foil is at the end of a project.

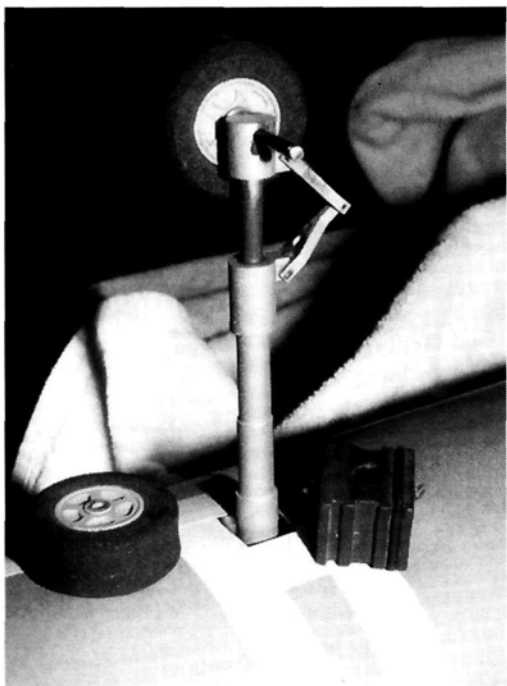
# 7

# 8

In fiberglass airframes, you find creative ways to mount servos. This photo shows a Futaba\* servo glued to Vi6-inch-thick plywood, which is then glued to a foam block. The foam can then be contoured and glued into the fuselage. Although this technique produces strong servo mounts, I wouldn't recommend it for servos that are used for critical functions. The white foam used for this mount is the same as that used in foam-core wings.

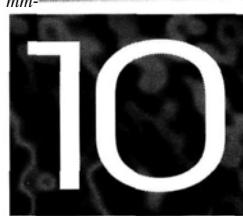
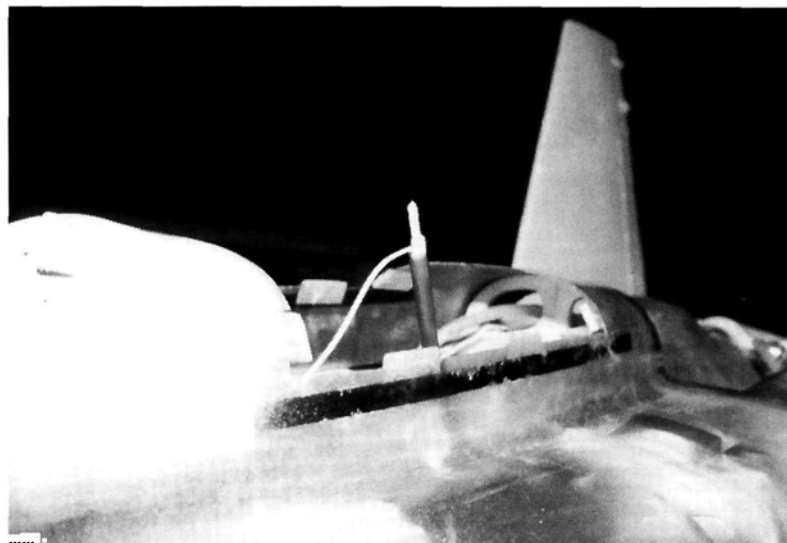


## Foam Servo Mounts



## Catching Clips

The technique shown in this photo can save your knees and back. When you install C-clips, or similar small metal parts, place a magnet near them. When a part slips out of your fingers, the magnet will catch it, and it won't become lost on the floor.



## Antenna Protection

Blue Nyrod tubing can be very useful for routing antenna wires through fuselages. To ensure that the antenna won't come out, cut the end off a cotton swab, and insert it into the end of the tubing.

I hope that these tips are helpful, because the more frustration we eliminate, the more fun we will have. In any event, just remember to "make haste slowly," and may all your problems be resolved.

\* Addresses are listed alphabetically in the Index of Manufacturers on page 170.

H

# FINALLY! We've Broken the Jet Barrier!

**By removing all the barriers that have stopped you from flying a ducted-fan jet, we've made it possible for you to build and fly one.**



**Q**uick-Build Jets™ molded-Lexan technology—our unique modular construction combined with our 2-hour instructional video, add up to the toughest, quickest-to-build, easy-to-fly, awesome-performance, great-looking, ducted-fan jet kit—and **A**n unbelievably low price.

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video is a complete, step-by-step, instruction manual of our three Quick-Build Jets™—Cheetah, Jaguar and Sabre—not just a commercial. If you prefer, you may order the video first, and when you purchase the kit, we will deduct \$20; or if, after viewing the tape, you are honestly not impressed or convinced that the kit is everything we say it is, we will cheerfully refund your money.

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**To order, phone  
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**Bob Parkinson Models USA**  
1140 Early Dr. NW, Palm Bay, FL 32907.



# AIR SCOOP

CHRIS CHIANELLI



*New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!*

## Wings Over Europe



**D**iscovery Communications—producers of the popular "Wings" television series—has released an interactive CD for personal computers that highlights eight of the most important aircraft to serve in the European theater of WW II. Like the TV programs, the Wings CD explores in detail the development, operation and combat role of each aircraft,

but it goes much more deeply into the subjects—especially when comparing aircraft from opposing sides that performed similar functions in the war.

The eight aircraft featured (Me109, Me262, Ju-87 Stuka, IL-2 Stormovik, Supermarine Spitfire, B-17 Flying Fortress, P-38 Lightning and, of course, the P-51 Mustang) represent the best in their respective classes, and each is treated in a thorough and entertaining manner. The operative word for this CD is "interactive," meaning that the viewer is given opportunities to explore each topic by clicking "buttons"



with a mouse. These buttons access video, audio, graphics, or text that explore the historical significance of the aircraft. There are also charts that compare size, range, ceiling, speed, armaments and climb rate of the aircraft, and profiles of the men and women who flew the aircraft to personal victory. As a bonus, this package also includes a demonstration copy of Aces Over Europe, the popular flight simulation game by Dynamix.

If you're a WW II buff, or you simply enjoy learning about historically important aircraft, this CD is well worth the suggested retail price of \$49.95. For more information, call the Discovery CD ROM info line at (800) 762-2189.

—Rob Wood

**Title:** Wings Over Europe.  
**Product type:** Interactive CD.  
**Publisher:** Discovery Communications, Inc., 7700 Wisconsin Ave., Bethesda, MD 20814-3579.

### Minimum system requirements

- IBM-compatible: 486 SX or better CPU, 8MB of RAM; DOS 3.1, Windows 3.1; VGA+ display (256 colors at 640x480 resolution); CD ROM drive, sound card, mouse.
- Macintosh: CD ROM drive, II Series, LC, Performa, Quadra, Powermac; 5MB of RAM, System 7.0, color monitor (256 colors).

## Here's the One

**E**agle Aviation has proudly announced its newest creation: a 38-percent scale model of the One Design. You can buy this one as a semi-kit or a full kit; it also comes framed up "in foe bones" to save time at the workbench. The scale outline model has a wingspan of 89 inches and a fuselage length of 80 inches. It was designed around currently available 3.2 to 4.2ci giant-scale motors. The fuse is built up with balsa and sheeting; the tail and wing are also built-up balsa; and the wings have symmetrical airfoils. The fiberglass cowl and wheel pants, wood, plans, hinges, horns, bolts and 4-40 clevises are included. Covered with film and carrying a 3.2ci engine, the plane weighs about 19 pounds. Semi-kit—\$160; full kit—\$385; built up to the bones—




\$995. Eagle Aviation plans to produce a 72-inch-er as well. For more information, contact your local hobby shop, or call owner Frank Noll at (513) 296-1290.

**D**o you own a model that deserves an extra measure of protection from flight-pack failure? Besides cycling and checking the health of your flight pack, consider using the Alkaline Battery Back-Up System. Plug this unit directly into your RX in an unused channel, or use a Y-harness, install the LED outside the model, and you're ready to go. Turn on your radio and the unit, and carve up the sky. If your IM-Cds fail, the Alkaline Battery Back-Up will take over, and you won't know the difference until you land and check to see whether the LED is lit. If you run the servos and the LED isn't lit, the Ni-Cds were doing their job, and all is well. If the light is lit, the Ni-Cds failed in some way, and they should be checked. Retail price: \$20.95. For more information, contact Universal Energy R/C Supplies, 130-C East Jeffry Blvd., Deer Park, NY 11729; (516) 586-9584; fax: (516) 242-8814.



## Flight-Pack Back-up System





## RACING LION

On the heels of its Gee Bee R-2, Byron Originals has announced its new Gilmore Red Lion—another design that's likely to warm the hearts of those who appreciate the classic beauty of the "golden-age" Thompson Trophy racers. The 1/4-scale plane features an 84-inch wingspan and a 72-inch length, and it can be powered by a Zenoah G-62 or equivalent. The model is patterned after Steve Halpern's Gilmore Special (featured in the April '94 issue of *Sport Aviation*). It incorporates flight-performance improvements made to the full-scale plane by the Kimball brothers of Zellwood, FL. Estimated kit and accessory price is in the \$550 to \$650 range, which includes main gear, tires, tail wheels and a complete hardware package. For more info, contact Byron at (712) 364-3165; fax (712) 364-2028.



GIANT DIAMOND UNLIMITED'S

## BIG BROTHER

Gilbert Aircraft Performance now provides the giant-scale set with a sport plane to be reckoned with. This 80.5-inch wingspan, 8.5- to 9-pound aircraft has 1,869 square inches of wing area, giving it a wing loading of about 10.5 ounces per square foot. Bolt on a .90 2-stroke, and you'll have a sport plane that's more maneuverable than most others of its size. Install a 30cc (1.8ci) 2-stroke glow engine on this ship and Gilbert says the performance will be absolutely unbelievable. The kit uses e-glass filament-wound composite tube spars for the plug-in wing panels and laser-cut lite-ply, carbon fiber and Kevlar, and it can be disassembled for transport in compact cars. This design appears to be the next generation in simplified, lightweight, composite construction. Retail price—\$199.95; introductory price—\$149.95. For further information, call (616) 772-1832 or (800) 325-4277.



## Add-On Expo

The SRE-2000 from Hobby Supply South simply plugs in-line between your 4-channel receiver and any servo for instant exponential. Switches 2 and 3 control the amount of exponential that the SRE-2000 applies to the servo-control signal. For newcomers who may not know, exponential softens stick response near center. Simply stated, this gives less servo movement when the control surface is near its neutral position and more response as the stick gets farther away from center. The total throw isn't affected. Switch 1 can also be used to reverse servo throw. While most modern radios have servo-reversing, this can still be useful when you're using two servos to control one surface (elevators, for example)—a common practice with giant-scale models. If you find the two servos are working in opposite directions, plug in the SRE-2000 on one side of the Y-harness and enable the reversing. The servos now work in unison. How convenient! For more information, contact Hobby Supply South Inc., 5060 Glade Rd., Acworth, GA 30101; (404) 974-0843; fax (404) 974-6243.

## Breakthrough Tachometers

Here's a technical advance deserving of your attention. Custom Electronics & Software's new prop tach provides stable, safe, accurate readings 3 or more feet away from the prop! Just point the high-sensitivity photo transistor at the prop, and read the LCD. Running a giant-scale twin, stand behind the plane, and point the tach back and forth at each prop to sync the engines. CE&S also offers three other tachs: a fan tach, a prop-fan tach and a jet tach, each of which includes a cable with an optics module so you can read fan or turbine blades (marked with painted stripes). CE&S notes that high-speed electronics in the first three tachometers read from 99.9 to 99,900rpm; the jet tach is said to be capable of readings to 500,000rpm! The first three tachs are calibrated to plus/minus 1 percent from 20 to 120 degrees Fahrenheit. The jet tach, which uses a temperature-compensated, crystal-controlled oscillator, is accurate to within 50 parts per million over an even larger temperature range. Retail prices: prop tach—\$60; fan tach—\$80; prop/fan tach—\$85; jet tach—\$100; extra plug-in optics modules—\$15 each. Contact CE&S at 2 Whites Ln., Woodstock, NY 12498; (914) 679-8549; fax (914) 679-5542.





CONSTRUCTION

# The Swick Taylorcraft

Radical modification  
of the venerable  
Taylorcraft has made  
it a very competitive  
aerobatic airplane.  
Amaze your friends  
with the agility of this  
 $\frac{1}{4}$ -scale beauty.



by JIM SIMPSON

**C**ONTRARY TO WHAT many of you may think, this is not just another Taylorcraft. This version is  $\frac{1}{4}$  scale and represents the famous planes built by Mike Swick at the Aero Country Airport just north of Dallas, TX. Mike starts with an old stock Taylorcraft airframe and completely rebuilds it to better-than-new standards. The control surfaces are modified, and angles are changed to optimize aerobatic performance. The

wings are completely dismantled and rebuilt to the new shorter span with metal spars, fiberglass wingtips and much stronger bracing. Ailerons are counterbalanced and incorporate boost tabs for better control response and feel. It uses Pitts pants on the main gear to reduce drag and look good.



COLOR PHOTO BY DAN PANKINS, B&W BY JIM SIMPSON

## CONSTRUCTION: SWICK TAYLORCRAFT

### SPECIFICATIONS

**Model name:** Swick Taylorcraft

**Type:** 1/4-scale aerobatic

**Wingspan:** 82.5 in.

**Wing area:** 1,300 sq. in.

**Weight:** 12 to 16 lb. (14 lb. as flown)

**Wing loading:** 24.8 oz. per sq. ft.

**Airfoil:** NACA 23012

**Washout:** none

**Length:** 68 in.

**Engine req'd:** 1.08 to 1.80 2-stroke; 1.20 to 1.60 4-stroke

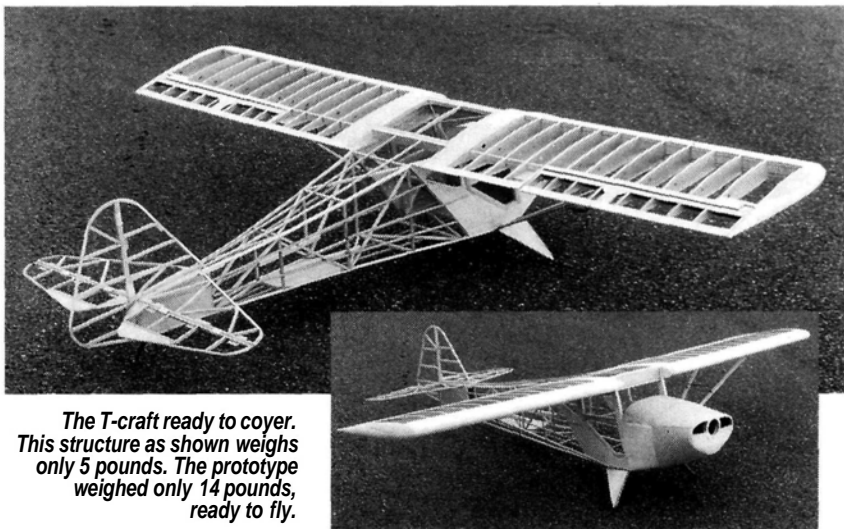
**Engine used:** SuperTigre 3000 on gas with ignition

**Prop used:** Zinger\* 18x6

**No. of channels req'd:** four with at least five servos

**Radio used:** Ace\* Micropro 8000

**Features:** removable wing panels; balanced ailerons; elevator and aileron boost tabs; optional fiberglass or plywood engine cowl; cabin doors; removable skylight.



*The T-craft ready to coyer. This structure as shown weighs only 5 pounds. The prototype weighed only 14 pounds, ready to fly.*

The best part of the Swick T-craft is its sparkling performance. My good friend Gil Horstman (now of Spokane, WA) and I once spent a day at the IAC Championships in Sherman, TX, watching these neat little clipped-wing planes flying beautiful

aerobatic routines and scoring so very well. If you doubt how well they do, just look in past records at all the various "modern" designs they beat the socks off.

You may build this plane true to scale to look like any one of many Swick T-crafts around the country. You may decide to build it just for sport, or you may decide to fly it in the new IMAC competitions. You can be sure that, regardless of which way you go, you will have a great

flying airplane. I have flown my prototypes with an O.S.\* Gemini twin 120 4-stroker, an O.S. 120 Surpass II 4-stroker, a SuperTigre 2500 2-stroker glow and a SuperTigre 3000 2-stroke ignition. These options are listed in order of increasing vertical performance; the last is best.

### SCALING THE SWICK

There were no scale 3-views of the Swick T-Craft available, so I traced the original blueprint of one wing and the full-size

## FLIGHT PERFORMANCE

*Take a moment to reflect on the weight, power and wing loading of this model. Compared with similar models of its size, it is generally lighter and much more powerful. This is desired because the same is true of its full-scale counterpart. Naturally, its flight characteristics are likewise surprisingly similar.*

### •Takeoff and landing

Ground handling is great because the main wheels are 21 inches apart and the wingspan is only 82.5 inches. I've used spring-coupled tail wheels on all four prototypes, and I like them tight for instant response. Taxiing is good on both grass and pavement. This clipped-wing version of the T-craft literally leaps off the ground, but with some practice, you can learn to let it raise its tail and fly off just like the Cubs do.

Landings are a sight to behold once you've learned the stall characteristics and are confident enough to approach low and hold it off until the plane has almost, but not quite, stalled. When you're in tune and grooving, it will do both wheel landings and three-point (tail-wheel first) landings. Yes, hot approaches will

buy you a "crow hop" or two.

### • Slow-speed performance

Of course, this is a function of wing loading, and because this model usually comes in lower, it is slower. It is possible to drag it around on the prop, and in light to moderate winds, apparent hover is possible. Stalls are straight ahead when slow, and the left wing drops first at all other speeds. There is a slow cruising speed that can be flown with a little backstick (up-elevator) and is fun to watch and/or do.

### • High-speed performance

The T-craft moves out smartly at full power and has a very long vertical up-line (again, a function of weight and power). Rolls are quick, very crisp and, with properly integrated rudder, look most realistic. This plane also does very pretty, level, rolling circles at full throttle, and the counterbalanced



*This is the third T-craft I have had published. The first was the famous Duane Cole version. He changed the tip bow, cut about 3 feet off the inboard end of each wing panel and added various reinforcements and a larger engine under a Piper cowl (October 1979, Radio Control Modeler). The second was a 1/4-scale version of the stock 1941 BC-12D that appeared on the cover of the May 1990 issue of EAA's Sport Aviation magazine (April 1993, Model Aviation).*

ailerons have yet to give any problem.

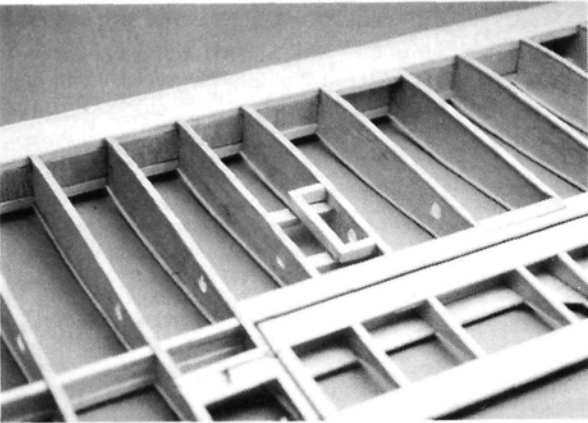
### • Aerobatics

The full-size Swick T-craft was specifically built for aerobatics, so this 1/4-scale version has similar capabilities. It is neither necessary nor desirable to fly at full throttle in level flight; therefore, looping maneuvers can be adjusted for size with both elevator

deflection and throttle position.

In the full-size plane, for aerobatics, the span was decreased from 36 feet to 27.5 feet but aileron size was not changed, so, the aileron authority is immense. Coupled with the very large rudder, which moves a great distance, the rolling and turning maneuvers may be anything from extremely slow axial rolls to lightning-quick snap rolls or anything in between. The NACA 23012 airfoil and dry tank, balanced as shown on the plans, result in a very realistic spin and minimum trim change from upright to inverted flight.

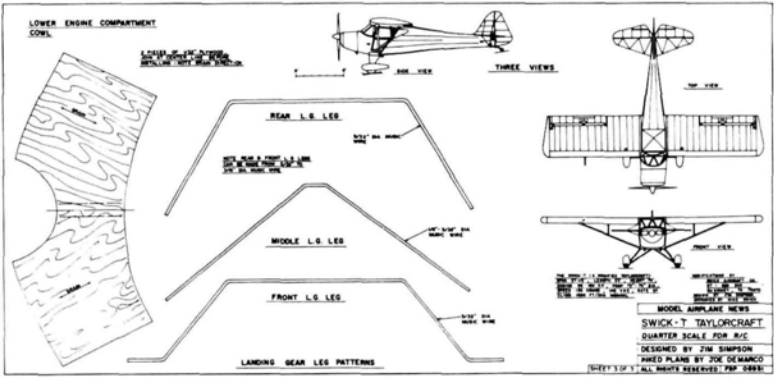




*This shot of the bottom of the left wing shows the inboard end of the aileron hinge pin and the aileron servo mount.*

parts, such as the rudder, one elevator, the firewall and nose bowl. Mike traced and sent me a wheel-pant outline. Using the factory drawings for the basic fuselage, I drew a set of 3-views and sent them to Mike for approval. He made a few necessary notes and changes and sent the drawings back. I modified them according to his directions and returned it for his approval, which he gave. He asked for a Mylar copy

and now uses the drawing in his promotional efforts. Having been an R/C modeler for 41 years and having built many scale jobs, I assure you that no 3-view I've ever seen (including this one) is perfect, but this one is close enough. The photos of the white-with-blue-trim version are of the plane that belonged to the late "Doc" McCullough. I was privileged to watch Doc fly at Sherman, and he and the plane were very impressive. *Editor's note: the model is built using*



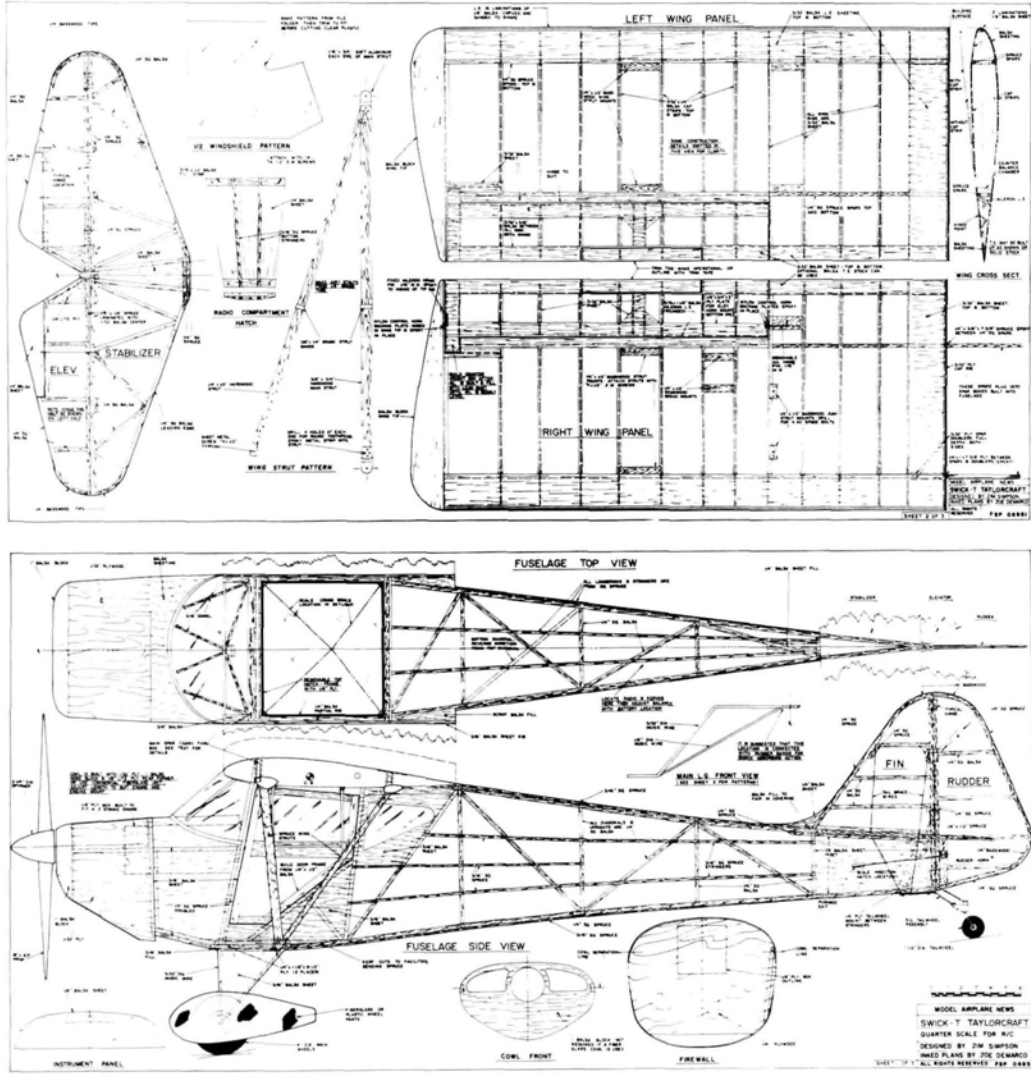
*balsa and ply and traditional construction techniques, as illustrated by the photos. Detailed building instructions and an extra copy of this article are provided with the plans as aids to the scale builder. The discussion now picks up with radio installation.*

### RADIO INSTALLATION

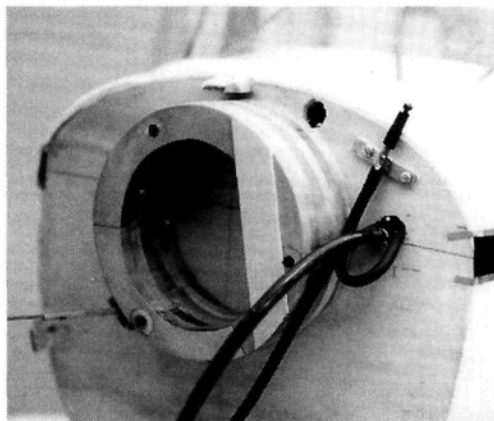
With the wings, struts and landing gear installed, set the plane upright and clamp the tail pieces into place—looks good, doesn't it? This is a good time to plan and install your radio and the control systems.

On all these clipped-wing T-craft models, I have found it most desirable to mount the radio system about halfway back in the aft fuselage. To do this, I glue a 1/4-inch-square balsa rail on each side of the fuselage inside the radio bay about 2 inches from the bottom longerons. Then cut an <sup>x</sup>A-inch plywood plate to just clear the opening and otherwise fill the area of the bay. Mount your entire radio system on this plate by cutting a rectangular opening near the rear edge for two elevator servos and the rudder servo. Cut another rectangular hole near the front to accept the throttle servo, and mount the switch between this servo and the other servos so you can run a 1/16-inch-diameter music wire through the fabric to actuate it.

To mount the receiver and battery pack, wrap them in "bubble pack," and glue Velcro®-brand fastener strips (available at any fabric store) to the plate to secure the receiver to the bottom and the battery pack to the top of the plate. Now cut and fit a 1/4 x 1/2 inch spruce crosspiece that will be epoxied into the fuselage at each end of the aforementioned plate in



## CONSTRUCTION: SWICK TAYLORCRAFT



**Left: this firewall has a wooden standoff ring that will allow you to mount a SuperTigre 3000 on ignition under a fiberglass cowl.**

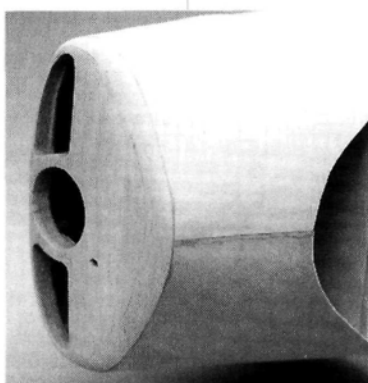
**Far left: the door windows are clear MonoKote, and the hinges are clear Mylar tape. A single sheet-metal screw holds each door securely closed.**

such a way that it can be secured with at least four no. 4x1/2-inch sheet-metal screws.

My favorite method of wiring the plane for the radio is to make a plug-in extension cord for the charger and route it to the cabin roof so that the charger can be plugged in through the skylight, which is always open to allow the removal and installation of the wing panels.

It's easiest to mount the aileron servos in the wing panels and wire the plane so that all you need to do is unplug the servo leads in the skylight. I run short, solid pushrods from each elevator servo to each half of the elevator and one

servo for the rudder. I run heavy, wire, threaded pushrods from each aileron servo to its surface, and I use a flexible pushrod for the throttle. If you have a different preference that works, by all means feel free to use it instead.



**The lower cowl is formed of 1/32-inch plywood; the large, half-moon-shaped, cooling-air exit also clears the exhaust stacks. The seam along the bottom allows the wood to be bent easily.**

In the process of installing the radio system, you have probably developed a good idea of how you want the doors and skylight to work. You may use transparent MonoKote\* for the doors and skylight window. You may either paint or "MonoKote" the frames. The removable skylight makes it easy to install the wing-retaining screws. Making the screws all permanent

probably strengthens the structure.

The skylight may be built over the plan or in place, either with balsa or plywood. I prefer to use no. 4x 1/2-inch sheet-metal screws to hold the skylight in place.

It's easiest to cover or paint the area between the firewall and the instrument panel before you install the painted-dowel framework above the instrument panel. I also prefer to paint the inside of the cabin before I cover the entire fuselage.

Before covering your T-craft, it would be to your advantage to sand with 240-grit then 320-grit sandpaper and then vacuum and "tack rag" the frame. The covering will stick better. The most realistic covering is cloth. The easiest cloth to use is Coverite's\* 21st Century fabric, and their paint matches best. Follow their directions exactly, and you will have a beautiful cover job. Install the windshield with RC-56 glue; add trim colors, pin-stripes, decals, etc., to suit.

## Lady with the "Right Stuff"

She grew up flying. "When did I decide I wanted to become a pilot?" Karen Swanson asks, with a laugh. "Oh, about age three."

She actually began learning to fly at around eight, taught by her physician father, Dr. McCollough who, in 1975, was national champion in the Sportsman category. From him, she gained not only a love of flying, but also the beginning of a desire to take part in a sport the general public doesn't even know exists: competition aerobatic flying.

Aerobatic flying comprises the loops, rolls, hammerheads, etc., one usually sees at an air show, but they're flown within a 3,300-square-foot "box" that's marked out on the ground by white panels at the corners—all before a panel of judges. Pilots fly in several categories, according to their level of skill, and they're judged on the precision of every maneuver; for example, a loop is easy to do, and it's one of the first things an aerobatics



**Karen Swanson—daughter of the late Bill McCollough—leans on the Swick T-craft she flew to win the Sportsman category of the 1994 National Aerobatic Championships in Sherman, TX.**

pilot learns. But it is very difficult to make it exactly round—not "pinched" at the top or flat on one side.

"I started formal flying lessons at age 16; got my license at 17," Swanson says. "But for several years, I didn't have an airplane, so I couldn't do any flying on my own."

But those years weren't all spent on the ground. For about eight years as

a hobby and then two years professionally, she worked as an air-show wing rider with pilots Jim Franklin and Earl Cherry. (Franklin was featured



## PREFLIGHT

Have a proficient R/C-knowledgeable friend check your installation, surface travel and alignment, but especially the balance. With the tank empty, set the plane to fly with the balance point at least *Vi* inch forward of that shown on the plans.



**The T-craft tail uses alignment keys and includes "boost" tabs on each elevator. The double braces are made of heavy, no-stretch, braided fishing line.**

Also take the time to balance the plane laterally. Suspend the plane from the ceiling by holding the tail-wheel axle with a coat hanger, and hold the prop so that the fuselage is horizontal; then add weight to the lighter wingtip until the wings will stay level.

Run the engine, adjust it, and test the radio with the engine running. Taxi the plane, and adjust the tail wheel to track straight.

## TEST FLIGHT

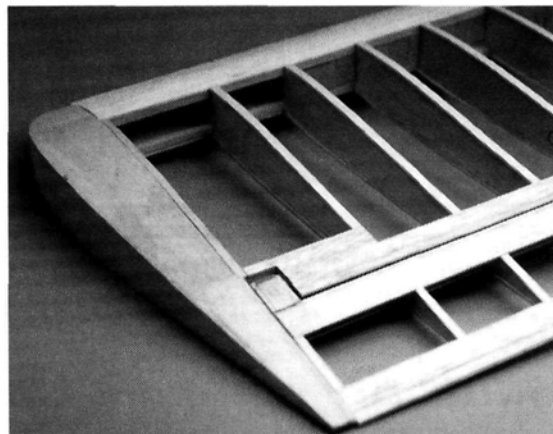
Plan to make the first flight a short one. If you have followed the previous recommendations and if you have no emergencies, such as radio failure or engine stoppage, you should be able to take off into the wind, climb to 300 feet and fly an overhead race-track or figure-8 pattern while you adjust radio trim levers; then make a normal approach and landing.

Before flying again, make the necessary changes in the control linkages to allow the trim levers to be reset to neutral. Also take the time to check every bolt, nut, screw, fastener, clevis horn, servo (especially output-arm security) and every surface for looseness, vibration, damage, etc.

## GETTING USED TO THE T-CRAFT

As you pile up the flights on your T-craft, you will gain confidence in its performance and reliability. At this point, you may want to shift the radio battery or add a little tail weight to move the balance point aft slightly. If you do this, do it a little at a time, and watch the elevator's neutral position. If it is not neutral for level flight, you're not right on the balance point.

As far as I know, this plane will do any maneuver you can think of (as long as the



**This view of the outboard wing shows the tip block and the aileron counterbalance.**

pilot is capable). The most spectacular maneuver I've ever seen was only done with a model, clipped-wing T-craft. From level flight, the plane is pulled up into a vertical climb, and the throttle is slowly adjusted to bring the plane to a hover. After a short pause, the controls are manipulated to cause the plane to move sideways in 10- to 15-foot-diameter circles; when the plane arrives back at its original position, the sideways movement is stopped and, after another short, deliberate period of hover, the power is increased, and the plane climbs vertically about 20 feet then slowly noses over to resume level flight! I've seen this done at least three times and, no, I can't do it myself. Can you?

Good luck and many greasy landings to you!

*\* Addresses are listed alphabetically in the Index of Manufacturers on page 170.*

in a segment of "Rescue 911" when his wing-rider fell and was rescued while dangling underneath the airplane on a safety line.)

In the late 1980s, Dr. McCollough began to build an airplane—a Taylorcraft. As is usually the case, the home-built project took several years. "He really never got to fly it," his daughter says. "He developed heart problems and died in May of 1990."

But he willed the blue-and-white aerobatics airplane to his daughter. "That was a challenge; it got me started with the idea of flying in competition."

She credits her former spouse, Gary Swanson—a competition pilot—with getting her back into aerobatics. "Dad taught me some aerobatics when I was a kid, but I had been away from it so long that it was almost like starting all over again." Both belong to Chapter 24 of the International Aerobatic Club, which has headquarters at a small, private airport outside McKinney, TX.

Karen decided to make her competition debut in the Sportsman category at the 1992 National Championships, which are held every September at the Dennison-Sherman Airport. (Contests may have four or five categories: basic, sportsman, intermediate, advanced and unlimited.)

Every contest has a trophy for the "Highest-Scoring First-Time Competitor," and it usually goes to someone in Sportsman—the category

in which most pilots begin. Swanson decided to shoot for that.

"And I won it! The Sportsman category that year was a *big* one with, I think, five other first-timers! I was as excited as if I'd won an Olympic gold medal!"

In 1993, however, she did not compete. She went through a divorce and was sick when the 1993 Nationals began—describes it as an "all-around difficult year."

"I also understand what it must feel like to be a 'single mother'," she said with a laugh. "The expenses of that airplane; well, I can afford to keep it and fly it, but I can't afford to do anything else! You could rent a decent apartment for what it costs every month just for hangar space." (There's a saying among pilots: "If God had meant men and women to fly, He'd have given us more money." Everyone who flies can identify with that!)

But, Swanson, who is now the sales manager of the Arlington Hilton hotel, had begun to tune up for 1994 with more optimism, and she took first place in the Sportsman category that year. This was no small achievement considering that the field included 11 Pitts biplanes, an Eagle, an Edge 360 and a Decathlon.

We congratulate her and wish her well.



# The New Aristo-Valiant Tracker

## 50 RF Channels Synthesized, Scanning + Full Computerization

POLK'S MODEL CRAFT HOBBIES INC., 346 BERGEN AVE. JERSEY CITY, NJ 07304  
PHONE 201-332-8100 FAX 201-332-0521

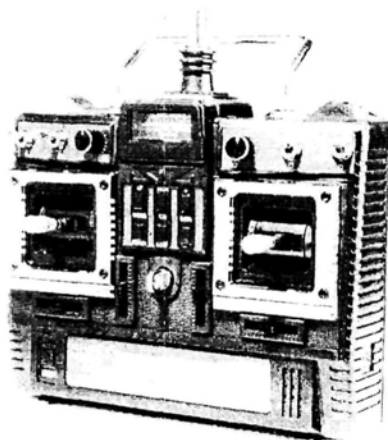
### Is this the Ultimate Computerized Radio?

**A**risto-Craft has been making radios since 1950, starting with single channel systems. This time we challenged our engineers to come up with the world's safest, bullet proof, feature filled, and user friendly radio! They more than exceeded our specs for our dream radio!

Aristo-Craft learned how to make a 50 channel synthesized radio and included scanning with the Valiant 8, and have now enhanced the functions to the ultimate radio of the 1990's.

#### Features included are:

- ◆ PPM or PCM selectable
- ◆ 5 Model Memory
- ◆ Exponential
- ◆ Trim Memory & Rate
- ◆ Tx & Rx Bat. Check
- ◆ Aileron Differation
- ◆ Flaperons & Elevons
- ◆ V-Tail
- ◆ Countdown Timer
- ◆ End to End Point adj.
- ◆ Mode 1 or Mode 2
- ◆ Fast Servo Response
- ◆ 50 RF Channel
- ◆ Scanning and R.S.S.I.
- ◆ 2 Mixes - 3 Way
- ◆ Dual Rate Adjustable
- ◆ Bullet Proof Receiver
- ◆ Low battery warning
- ◆ Permanent Memory Settings w/Cmos chip
- ◆ Last Freq. Retention.
- ◆ Helicopter Compatible
- ◆ Cross trims



*The New Valiant Tracker is as Smart as it is Beautiful  
Fully computerized, programmable, scanning, and  
synthesized 50 channel selection without crystal change!*

The Valiant uses state of the art Surface Mount Technology to insure perfect boards, and the boards are computer checked during production. Additionally, the Valiant Tracker has a self test every time the radio is turned on.

The connection between the transmitter and the receiver is accomplished through a communication cable to the mounted switch on the outside of your model. **All settings remain permanently in memory even if battery is removed.** Safety requires that scanning is required each time you change frequencies. All flag combinations are provided, so that full compliance with A.M.A. rules and compound etiquette can be maintained.

The Valiant Tracker is F.C.C. approved, and a patent is pending for the scanning and synthesizing of frequencies. **Please note that it is impossible to transmit on to a frequency in use even in a field several miles away or on to a frequency with interference.**

Therefore, it is impossible to shoot someone down by mistakenly turning on your radio while someone else is flying. We can't emphasize enough that this feature alone makes the Valiant the safest radio in Model Aviation History! Available on 72 or 75 Mhz and Mode 1 or 2. Optional 6 additional on/off channels available w/decoder in separate case. All foreign frequencies will be available from agents. In Europe see Powermax.

### The Safest and Most Bullet Proof Radio!

**P**OLK'S HOBBIES has been in the hobby business since 1935, and their founders, Nat and Irwin Polk were founding members of the A.M.A. and are member of the Hall of Fame. This radio is not a fantasy from a new company, but the most serious project to bring deluxe capabilities to flyer at affordable pricing.

Our reputation of 60 years of supplying the hobbyist is on the line, and we want to make the Valiant everybody's basic radio of choice to do so we assembled an engineering team of experienced radio engineers to introduce ground-breaking technology to you.

Polk's will offer a **money back guarantee** to any member from each A.M.A. approved flying club for testing. Fly for 30 days without risk, and if you don't agree that the Valiant Tracker is the "Ultimate" radio than you can return the radio to us for a full refund. This offer is valid through 06-30-95

8 Ch Dlx. Sys. \*\$479.95  
6 Ch Std. Sys. (1995) \$379.95  
Spare Receiver \$149.95  
Opt. 6 on/off \$ 99.95

\*SECOND RX DIRECT FROM ARISTO AT 1/2 PRICE WITH PROOF OF SALE! (INTRODUCTORY)



# PILOT PROJECTS

## A LOOK AT WHAT OUR READERS ARE DOING

### SEND IN YOUR SNAPSHOTS

*Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.*

*All photos used in this section will be eligible for a grand prize of \$500, to be awarded at the end of 1995. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!*

*Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.*



### ROYAL DOGFIGHTER

Lenny Giannacco of Bethpage, NY, sent this great flight shot of his  $\frac{1}{3}$ -scale Sopwith Pup. Built from the Balsa USA kit, the model flies well on a Zenoah G-62 engine. Lenny says that Clyde Geist of AMP Graphics gave the Pup its beautiful finish.



### F1 RACER

This  $\frac{1}{3}$ -scale Miller JM-2 Pushycat was designed and built by Art Williams of Fischer, TX. The 18 $\frac{1}{2}$ -pound, 72 $\frac{1}{4}$ -inch-span model has a vacuum-formed fiberglass fuselage and wing center section and foam wing panels with honeycomb spars. A SuperTigre 3000 powers a Zinger 18x10 prop with a TruTurn spinner. For the past three years, Art has been the crew chief for the full-size Pushycat at Formula One races, and he says that he "enjoys every minute of it."



### 1/6 SANDY

Charles Valentino of Ronkonkoma, NY, spent six months scratch-building this Douglas Skyraider from Nick Zioli plans. The 1/6-scale, 100-inch-span model is covered with 1/8-inch-thick planking, Super Coverite and spray paint, and all the markings are hand painted. The guns in the wing are 20mm cannons, and everything except the canopy is handmade. The full-size Skyraider was used in Vietnam and was assigned to the U.S.S. Intrepid, which is now docked in New York as a museum.

### THE DAWN PATROL

Manos Patihakis of Thessaloniki, Greece, sent this photo of his fellow club members with their 1/6-scale WW I models. The Sopwith Doves were scratch-built from modified Sopwith Camel plans, and the Fokker D-VII are Flair kits. Each model is powered by a Saito .60 engine with a homemade exhaust muffler. Manos says that "they have lots of fun flying them and chasing each other in combat formation at local fly-ins."



# PILOT PROJECTS



## AIR ROTTERDAM

This 1/10-scale, 2-inch-span Douglas DC4 was built in four years by Paul van Beem and Frans Bal of Vlaardingen, Holland, for the Royal Dutch Flying Organization's "Operation Scale" show. Powered by four O.S. .70 Surpass engines pushing 12 1/2x7-inch 3-blade props, the 50-pound plane has Oleo strut retracts and 11 servos and is covered with Solartrim. The DC4 also has a balsa-sheeted foam-core midsection with multiplex spars, and its fuselage is made of hand-laid fiberglass.



## CALLING ALL SPACE CADETS

Stan Suhaka of Englewood, CO, scratch-built this model of the 1954 "Anti-Grav" Martian Spaceship from Skip Ruff plans. It's about 5 feet long and weighs approximately 3 1/2 pounds, and it's powered by an O.S. .28F engine. Stan says that the model flies (he has videotape to prove it!), but he's still learning to maintain orientation during flight.



## TWIN-ROTOR AUTOGYRO

Mercer Helms of Houston, TX, scratch-built this Osprey Autogyro from *Model Airplane News* plans. He modified the main gear to accommodate rough flying fields and instead of vacuum-forming the fuselage pods and nose cowl, he built them out of stacked balsa sheets. The windshield is made out of a 2-liter soda bottle. Mercer powers his 66-inch-rotor-span model with an Enya 19.



## DANGEROUS LIAISON

This 1/4-scale 0-1 Bird Dog (L-19E) belongs to Duke Aulenback of Edmonton, Alberta, Canada. He used Roy Vaillancourt plans to scratch-build the 23-pound, 108-inch-span plane, which has a scale instrument panel, panel lines and rivets. The model is covered with fiberglass and Endura paint, and it's powered by a Zenoah Quartz G-38 engine. Duke tells us that in 1964, the subject aircraft flew with the 73rd Aviation Company in South Vietnam.

## ZIMBABWE ZINGER

Three-year-old Megan Coutts, of Harare, Zimbabwe, shows off this modified T-tail Zinger that was scratch-built by her father, Andy. He tells us that the model's elevator is very sensitive and that the rudder needs to be slightly larger for more response but that the plane flies extremely well off slopes. He controls the Zinger using a Futaba radio with mini-servos.







# Raven

GLOBAL QUALITY KITS

A 60-SIZE VERSION OF  
WAYNE HANDLEY'S  
AEROBATIC WONDER

by TED CONNOLLY



**T**HE FULL-SCALE VERSION of Wayne Handley's Raven is typical of today's high-tech aerobatic aircraft. The Raven's light weight and its 330hp Lycoming engine allow crop-duster-turned-air-show-performer Handley to present his unusual routine without a hitch. Handley's air-show routine comprises a number of *maneuvers* and combinations, such as "bug flickers," "wfioo-wee tumbles" and "ratchet rolls." (He calls these maneuvers "agrabatics" rather than aerobatics.) Who else but a crop-duster would think of doing an eight-point roll and Lotncevak (excuse me—a "ratochet roll" and a "bug flicker") on hfs final landing approach just to "eliminate cleaning up time airplane."





*Aligning and gluing the ribs creates two wing halves.*

Wayne Handley's flying skills and the Raven's agility are an awesome combination. The plane's list of accomplishments includes jet-like acceleration (a standing start to 100mph in just 8 seconds) and a roll rate of 270 degrees per second. It's easy to understand why Wayne holds the current world's record during official competition for inverted flat spins—an unbelievable 67 revolutions!

Global Quality Kits\* has released a 60-

series were complete and of good quality. The two 36x60-inch rolled plans are very detailed and well-drawn by Todd McVickar (Bob's son). The instruction book is easy to follow, and it includes construction photos.

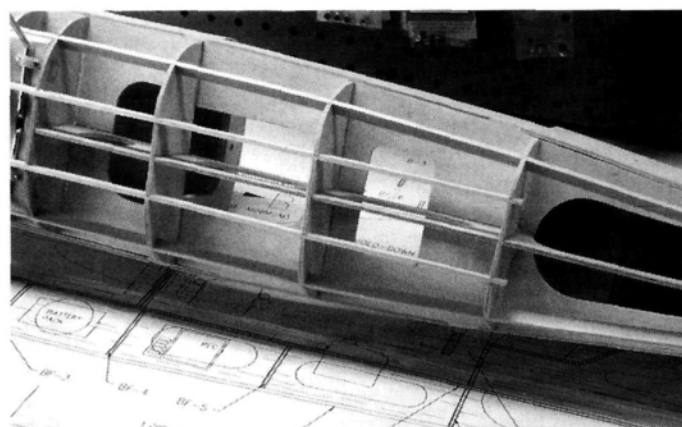
## CONSTRUCTION

I used a variety of CA products and epoxies, including Kwik-Bond\*, to build this model. The building process began with

the tail surfaces. I framed the rudder, elevators, fin and stabilizer with the supplied V32-inch balsa and die-cut parts, then I sheeted them to produce strong, lightweight components. No surprises, problems, or ill-fitting parts surfaced here.

The sleek design of the fuselage went together easily and quickly. Granted, it looked a little strange

when it stood alone, but this is pretty common among shoulder-wing designs. The fuselage should present no surprises to the average modeler.



*The bottom formers are connected with stringers; then sheeting is applied.*

size version of Handley's Raven. Upon opening the big, colorful box, it was obvious that Bob McVickar, director of Global's manufacturing division and the kit's designer, has devoted a lot of time to the production of this kit.

## INSIDE THE KIT

Nothing in the kit was missing, and none of the parts was damaged. The wood itself was straight and was of extremely high quality; in addition, the wood cutting and the die-cutting were done cleanly without compression. This is truly the best die-cutting job that I've seen in my 26 years of building kits.

The hardware package and other acces-

## SPECIFICATIONS

**Name:** Raven 60

**Type:** stand-off scale

**Manufacturer:** Global Quality Kits

**Wingspan:** 62 in.

**Wing area:** 638 sq. in.

**Wing loading:** 27 oz./sq. ft.

**Weight:** lb.

**Wing type:** symmetrical

**Fuselage length:** 50.5 in.

**No. of channels req'd:** 4

(aileron, elevator, rudder and throttle)

**Engine req'd:** .61 2-stroke, .90 4-stroke

**Engine used:** Magnum .65 GP S/C

**Radio used:** Hitec/RCD Prism 7 with 4 HS 422 servos

**Propeller:** APC 13x6

**Kit construction:** all wood (balsa, lite-ply, balsa/ply, hardwood)

**Wing construction:** wood, built-up, double spar, partially sheeted

**List price:** \$184.95

**Features:** great decals; extremely nice die-cutting; high-quality wood. Includes all necessary wood; clear plastic canopy; formed-wire main landing gear; leaf-spring, tail-wheel gear assembly; molded cowl; custom spinner; one-piece molded wheel pants; special Raven decals; all necessary screws, clevises, horns, rods, hinges and bolts.

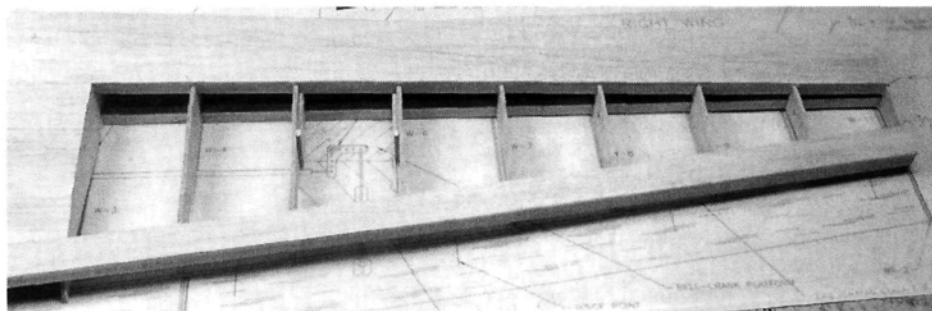
### Hits

- Easy and quick construction with simple and easy-to-read instructions and plans.
- Excellent components.
- Spacious fuselage with easy access.
- Excellent flight characteristics.
- Great-looking model aircraft.

### Misses

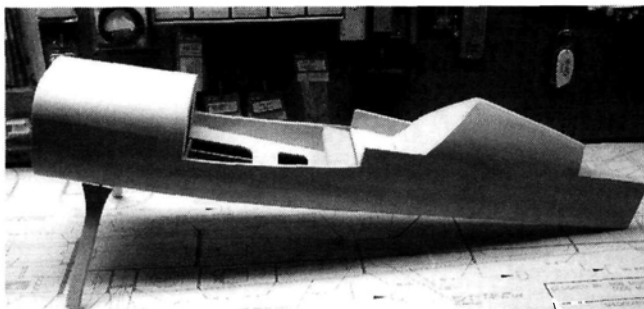
- A one-piece cowl would be nice.
- Even after completing a "ratchet roll," a "who-wee tumble" and a "bug flicker," as instructed just before landing, I still had to clean up the airplane.

The Raven performs very well using a variety of engines. I chose the Magnum\* GP .65 S/C because it doesn't produce an excess number of rpm, but it does have a great deal of power and torque at lower rpm.



*The 62-inch wing is partially sheeted, and the remaining ribs are capped. The completed wing is very strong and lightweight.*





*The completed fuselage with landing gear in place.*

The wings were next: the upper and lower spruce spars and the balsa ribs and the sheeting. The wing halves were strong

but light, and they were easy to assemble.

After getting everything to fit straight, it was time to get serious about sanding and filling in the boo-boos. I used Bondex Patching Plaster for filling; it's light, sands nicely, and it adheres well. That was the easy part; living in Illinois presents its problems when winter building projects reach the final sanding stage. Finding a place to do the sanding

can sometimes be difficult. Even if you sit in the backyard, ankle-deep in balsa-colored snow, don't rush this job. If you want your Raven, or any building project, to look nice, this step is very important. The balsa/ply used in this kit worked up so nicely as I made my way through the different paper grits that, by the time I got to the 400-grit paper I wanted to use urethane finish rather than the iron-on covering.

## FINISHING THE RAVEN

Applying an iron-on finish to a model is a job that people either love or hate. I enjoy it because you can really show off all your

## FLIGHT PERFORMANCE

### • Takeoff and landing

The Raven took off from smooth sod and from rough new sod, and both results were very good. As with any spring tail-wheel assembly, I tightened the spring mechanism for use on the rougher grass. With all the controls set at neutral and the throws at the recommended settings, the takeoff run was like a Bing Crosby golf drive (straight down the middle). At half throttle, the tail was already up and level. Even in the rough sod, the wheel pants were not a problem. The model gave no indications of nosing over, and it required no elevator input to hold it level while on the ground. With a light application of elevator, it was on its way with very smooth rotation.

During climb-out, a small amount of rudder deflection (the degree of which depends on side-wind conditions) was required to compensate for the motor's torque. Otherwise, the model tracked straight and true. The wind conditions varied; the worst was a 24mph side wind that proved to be no match for the Raven's large rudder surface. The climb-out is rock-solid and, like the full-size version, this thing has some serious acceleration capabilities.

The Raven lands like a trainer. I tried to land more with throttle control and, after lining up on the runway, it was a simple matter of adjusting my throttle control enough to determine the spot on the runway where I wanted to land. The wingtips remained remarkably level and quiet even in gusty wind conditions.

I have mixed emotions about the "perfect three-point landing." I've always felt that a tail dragger was meant to land on its main gear with its tail high in the air until it was time to steer with the tail wheel. I guess three-point landings are less work but, to me, the prettiest part of any flight is the sound of the wheels hit-

ting the grass followed by that ever-so-gentle touch of the tail wheel. Even if you hate doing three-point landings, the Raven may just change your mind.

To achieve initial straight and level, hands-off flight, the model required only one click of right rudder trim, one click of up-elevator trim and no compensation on ailerons.

### • Low-speed flight

The word "stall" doesn't exist in the Raven's vocabulary. It's one of a few models that I've seen that doesn't stall, but falls. If it's properly balanced, the model will continue to fly straight and level until the lack of air speed allows it to come straight down like an elevator. Gently apply power, and it's off to try something else. As long as the control-surface throws are adequate, you're always in control of the Raven, even at the slowest speeds.

We flew the Raven with different props and came up with two favorites: the APC\* 13x6, which gave the powerful Magnum .65 excellent power and worked well for aerobatic purposes, and the APC 12x6, which enhanced the plane's trademark acceleration and cat-like quickness. To test the plane's powerless-flight ability, I intentionally shut the engine down. I made no attempts to match any endurance flight records and headed for the field and a landing approach. The model remained very solid (the nose was kept no higher than level), and landing was no problem. Even after the air speed had dropped off close to touchdown, it still remained very stable.

### • High-speed flight

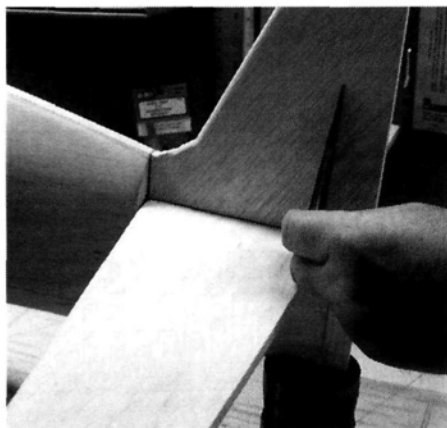
When set with great amounts of control-surface deflection, some aerobatic-type models have the tendency to surprise you sooner than others. The most common "surprise" is what I call "elevator stall" at

full deflection. The first time this happens to you at the bottom of a loop, it can be a little unnerving to have to relax your elevator controls in order to regain elevator effectiveness when the ground is rushing up to greet your model. We headed for the sky with all the surfaces as hot as possible (maximum control-surface throw) to test for these conditions. With our elevator throw set at 1 1/4 inches, I made numerous attempts to create this problem and was not able to do so during a loop or any other maneuver.

### • Aerobatics

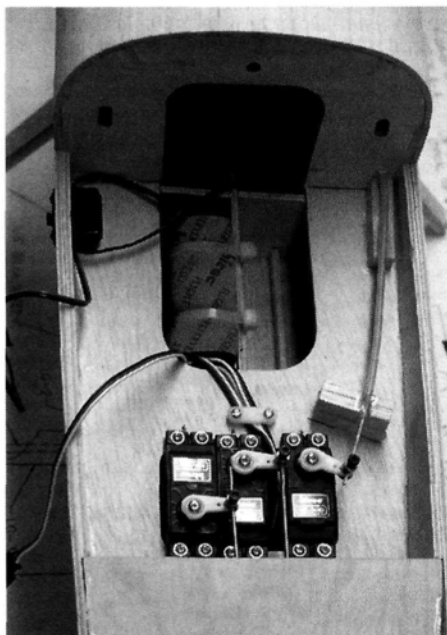
This is really simple; first you decide what you want to do, then just go do it! Anything you can dream up, this plane will do for you. Rolls are very quick, and they start and stop when you do, not when the plane has finished. The Raven's ability to perform low-altitude maneuvers instills confidence at an early stage, but I'd enjoy seeing this model pushed to its limits by a very talented aerobatics pilot. We did the best we could and flew our list of tricks, plus a few others that we couldn't believe ourselves! The Raven was still asking for more.

An important part of performing aerobatics is seeing the plane at all times and knowing where it is. This is one of the most highly visible planes that I've ever seen in the sky. The color scheme of Wayne Handley's full-size plane worked very well on the model, and when it banks up to expose the large black bird outlined in gold against the plane's red wings, there's no doubt as to what attitude the plane is in. Inverted flight happens naturally with as much stability as flying normally. The knife-edges were also impressive, but the stability and lack of any tendencies to fall out of any of the maneuvers that we attempted at either high speed or low speed impressed me the most.



*The addition of the stab and the fin is a simple matter. Both are square and level.*

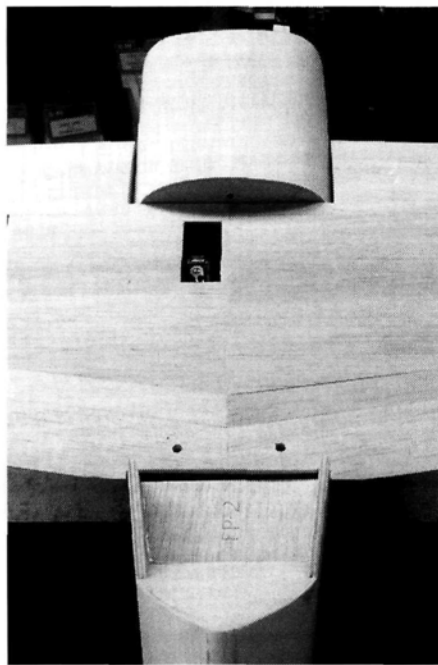
hard work. I used Solarkote\* for this job and was very pleased with the results. The included decal sheets feature a beautiful, large, black raven with its wings spread over the plane's wings. These decals are made of a vinyl material that allows better application around tricky curves and produces a very unusual and great-looking reproduction of Handley's original graphics and paint job. I "floated" the decals into



*The spacious radio compartment made it easy to install my Hitec HS-422 servos and the remaining airborne package.*

place with water and a mild detergent, and I used the alignment marks and instructions on the sheet to ensure proper placement. I was pleasantly surprised by how simply it all matched up and how great the finished product looked. I also used the excess yellow material from the decal sheet for the accent stripes on the fuse.

After I had joined the cowl halves, added some glass cloth for strength and fit-



*The completed wing fits into the fuselage very well with an excellent matchup in the wing-saddle area.*

ted the cowl in place, I asked my friend Steve Puckett to paint the cowl. To ensure a good paint match, we made a trip to Kim Shirley's auto-body repair shop with covering samples in hand. We left with a custom paint mix that matched the covering perfectly.

## RADIO INSTALLATION

During last year's flying season, I experienced a number of serious "hits" on my radio system. On one occasion, I remember flying straight and level when it seemed as if someone had opened the gate to a rodeo bull. In fact, a friend standing behind me shouted, "That was neat; do it again." A couple of calls to the manufacturer provided me with some scary information. For example, they recommend that you don't fly within 1 mile of existing power lines (good luck finding that location east of the Mississippi River). Rather than make extremely long drives to locations where I could use my present equipment with confidence, I decided to explore other equipment options.

I gave a great deal of thought to the selection of a new radio system because, over the years, my old standbys had provided me with reliable service. The Hitec/RCD\* Prism 7 won me over with its many features: trim lock, 10-year data memory and simplified, but adequate, programming. The biggest plus for this radio is its narrow bandwidth and its excellent noise rejection. The system fit into the fuselage with room to spare. I allowed for the recommended 3/4 inch of movement on



*With the supplied mount and hardware, the installation of the Magnum .65 is straight-forward.*



*The large stock muffler is extremely easy to incorporate and doesn't distract from the overall appearance of the completed model.*

the control surfaces as a starting point, and this seemed to provide adequate "bug-flickering" capabilities.

## SUMMARY

The Raven is a winner! It's durable, well constructed, and it flies extremely well. It's neither overbuilt nor too heavy, and it's solid yet *extremely* agile.

I completed my kit in just over three weeks. I've tried to find something wrong with the building process and the performance of the finished product, but I've failed to do so. I would have preferred a one-piece molded or fiberglass cowl, although I had no problems joining the two halves.

The Raven is a smooth, beautiful flier with no bad habits, and it performs as well as any air-show "hot dog." Global has put together a high-quality, reasonably priced kit. I congratulate Bob McVickar. The one major trademark of Bob's designs is that they always fly extremely well.

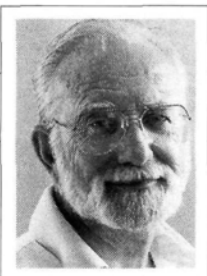
Now I can think about building the Tecate .45 biplane that Global will release soon. I hear that this one does a great knife-edge loop. What could I name that maneuver? I think I'll give Wayne Handley a call for some ideas.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 170). 1



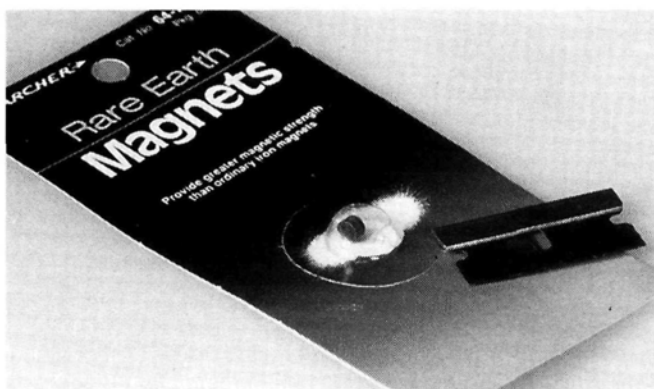
# HOW TO:

RANDY RANDOLPH



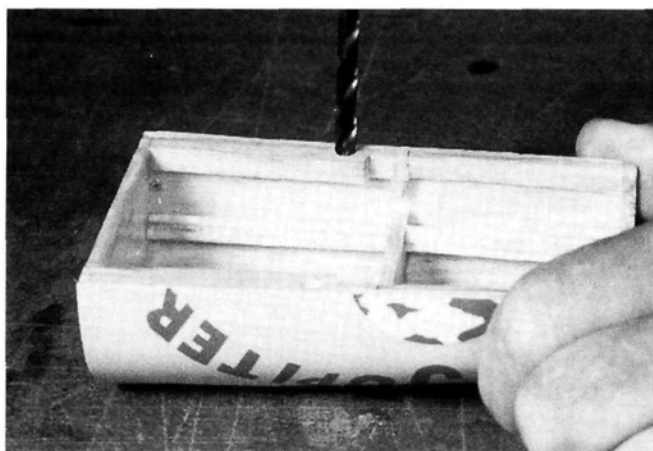
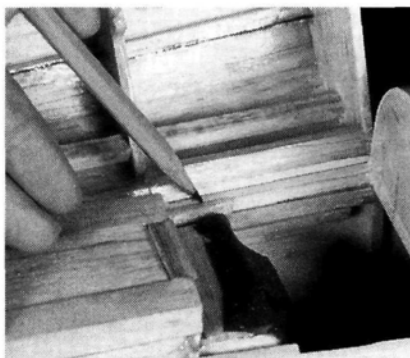
## USE MAGNETS FOR HATCH CLOSURES

Systems using everything from springs and rubber bands to screws and Velcro®-brand fasteners have been used to hold hatch covers in place on airplanes. The photos show how to use inexpensive, strong magnets to latch that hatch!



**1** You'll need rare-earth magnets (available in packages of two from Radio Shack), a razor blade, a 3/16-inch drill bit and CA.

**2** Two magnets are necessary for small hatches, and four or more are required for large hatches and for those in areas that will be subjected to a lot of stress. Mark the magnet locations on the hatch and on the airplane.



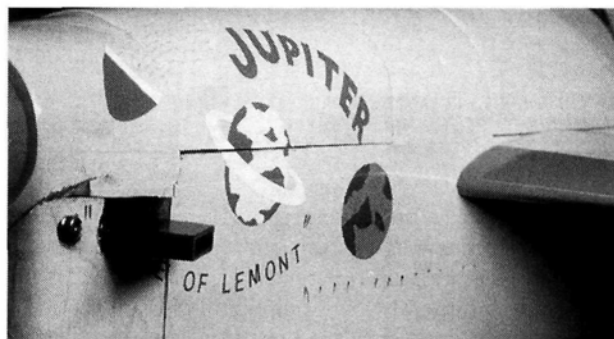
**3** In the places marked, drill a 3/16-inch hole just deep enough to allow the magnets to be installed flush with the surface of the hatch. In this case, only two magnets are used but, for a more secure grip, four could have been used—one on each corner.



**4** Glue each magnet into the hatch with thin CA. The CA will wick into the magnet/wood joint and form a good bond. You can also use aliphatic-resin glue; put some into the hole, press the magnet into the glue, and wipe away the excess.



**5** Break 1/4-inch pieces (or larger) of a razor blade and glue them onto the airplane so that they'll be directly below the magnets. The wood just below these pieces could be relieved to make them fit flush with the surface. (Please wear safety glasses.)



**6** The finished hatch is in place on the airplane. The holding power of these magnets is surprising. In fact, rounded hatches like these are sometimes difficult to remove if their surfaces are oily!

PHOTOS BY RANDY RANDOLPH

**E**ASILY recognized as one of the leading acrobatic aircraft in the world today, the Extra 300S represents the epitome of purebred design and grace. Built by Walter Extra of Germany, these handmade aircraft have made their way to championship status at least twice—in both cases, flown by Patty Wagstaff of the United States.



# BYRON Extra 300S

by MIKE LEE

**A scale sky dancer with spectacular performance**

## BYRON'S "S"

Byron Originals\* is one of several manufacturers to model the Extra 300, but they took it a bit further than others. First, this is a Vs-scale, .90- to 1.20-size model of the 300S—a low-wing variant. The standard Extra 300 is a mid-wing design. Second, they not only made an outstanding scale version of the aircraft, but they also made a model of the pilot (Patty) for her approval—and approve, she did! According to Patty, the Byron version of the Extra 300S is the most authentic seen to date (and she should know!).

## THE KIT

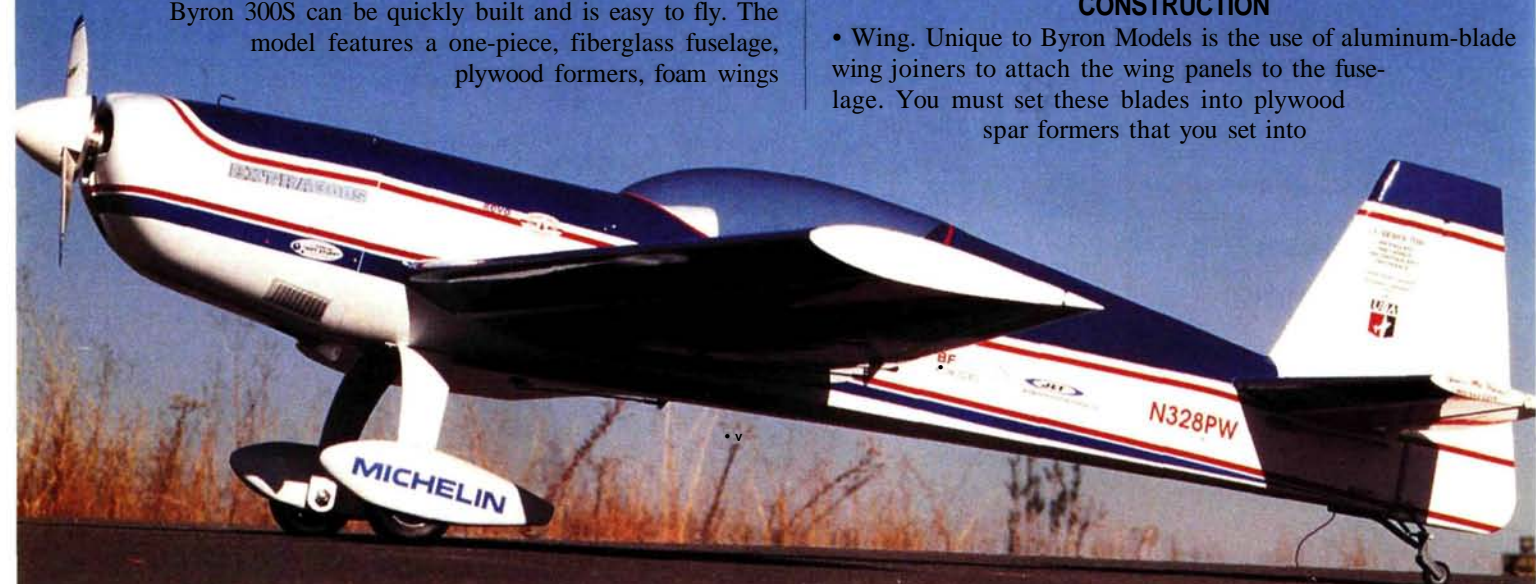
Constructed of fiberglass, balsa, plywood and foam, the Byron 300S can be quickly built and is easy to fly. The model features a one-piece, fiberglass fuselage, plywood formers, foam wings

and tail section, a few vacuum-molded plastic parts and a very comprehensive hardware outfit that's second to none. The kit's hardware includes Robart Hinge Points to hinge all the flying surfaces; many other kits come with hinges, but not *premium* ones. This is my third Byron model, and I'm continually amazed by the amount of hardware they include. Kudos to Byron for this.

The well-illustrated instruction manual has plenty of photos; some details were missing, though: in the step in which you cut out the fuselage hole for the landing gear, a landing-gear-strut cover is mentioned. This is the first and last mention. So keep in mind that this plane isn't intended for novice builders or fliers.

## CONSTRUCTION

- **Wing.** Unique to Byron Models is the use of aluminum-blade wing joiners to attach the wing panels to the fuselage. You must set these blades into plywood spar formers that you set into





At high speeds, (his bird comes into its own; it's smooth in the roll and pitch axes,



Author Mike Lee strikes a pose with his new Byron Extra 300S. The model is a great performer and has attractive scale lines.

the foam wing-cores before you sheet the wings. These formers are glued to the wing skins as well as the foam-core, and they provide a very strong spar system. In the case of the Extra, it takes more lime for the adhesive to cure than it does for the actual assembly job. To bond the wing skins to the foam-cores, I like to use Hobby Poxy\* adhesive. Epoxy allows you plenty of time to adjust the skins before it sets.

When you've sheeted the wings and have the wing joiners in place, you add the leading and trailing edges and the wingtip block. Don't throw away any scrap; you'll use some pieces later. A plywood root rib is used on the wing root, but it isn't installed quite yet. For now, you add the ailerons and cut out the aileron servo slot (two servos are required for aileron control—one in each wing panel). The servo bodies do marginally stick out into the

making maneuvers a lot like those of a pattern ship.

wind, so serious scale buffs may want to change this setup to conceal them. If you prefer, you can hinge the ailerons now, but don't hinge anything else yet. The fuselage must be assembled first.

• **Tail.** Next is the horizontal stab, which is also made of sheeted foam. This takes a bit more work than usual, because when you have the cores sheeted and you attach the leading and trailing edges, you must cut the elevators out of the stab.

Then add another set of leading and trailing edges to the cut-out parts, and you end up with a scale horizontal stab and elevator. Both the wing and the stab tips are flat. This makes them easy to build and cover.

The vertical stab comes already molded into the fiberglass fuselage; you only have the rudder to assemble. The rudder is completely built up with balsa—ribs covered with sheet-balsa skins. Building this part requires patience, and the emphasis is on maintaining a flat rudder. When the glue has set on this rudder, that's it. If you build a warp into it, the warp will be there forever. I used Satellite City's\* Hot Stuff Super T adhesives on all the wooden assemblies because it cures so quickly. Topping off the rudder is a large balsa block that forms the upper rudder counter-balance. This is the only rounded part you have to cover—a no-sweat affair.

• **Fuselage.** This one-piece fiberglass unit must be handled carefully, because its edges are sharp enough to cut your fingers if you're not careful. A quick swipe with 80-grit sandpaper around the edges cures this. The fuselage detailing is very nice, and the cowl is even better.

Assembly begins with the fuselage cutouts; you must remove material from the wing root, the stabilizer and the landing-gear-strut areas. Do this carefully; I used a Dremel Moto-Tool. There are a couple of other spots from which you must remove material, but don't cut out the pushrod exits at the rear of the fuselage yet. Check the positions of the exits before you cut; my fuselage had one cutout marked on the right side of the fuselage for the elevator control rod, but none on the

## SPECIFICATIONS

Type: scale aerobatic

List price: \$329.95

Wingspan: 71 in.

Weight: 10.5 lb.

Wing area: 838 sq. in.

Wing loading: 28.9 oz. per sq. ft.

Length: 56 in.

Engine req'd: .90 to 1.20ci

Prop used: Zinger\* 14x8

Airfoil type: symmetrical

Washout built in? yes

Wing construction: balsa-sheeted foam-core

Kit construction: fiberglass, foam, balsa and ply

**Features:** with the exception of paint, covering, an engine and a radio, this superb kit has everything you need. It can be built quickly and has good details. The Universal Engine Mount makes engine mounting easy. For experienced pilots, this is a fun bird to fly and show—a good scale project.

### Hits

- Complete, top-quality hardware kit.
- Attractive looks.
- Good flight handling with snappy maneuvers.

### Misses

- Plywood die-cutting needed further cutting.
- Some details left out of instruction manual.

left side. Plan carefully before you start cutting into the fiberglass.

Next, install the plywood formers in the fuselage while you install the wing panels. The die-cutting around the plywood formers wasn't clean, and I had to cut several parts out with a saw. Having cut out the formers, I found their installation straightforward.

To align the wing with the fuselage properly, you must mate them when you install the F-2 and F-3 formers. I used a slow-setting epoxy for this because strong joints here are critical. There are only three formers in the fuselage, and they do a marvelous job of stiffening it. When the formers are in place, the horizontal stab is installed.

Former F-1 is set in place at the very front of the fuselage. Make sure that adhesive is applied to its rear surface, because the motor-mount former lies flat against its front surface. This firewall arrangement is, again, unique to Byron kits. The design



Aileron servos are installed in the wings just in front of the ailerons. Simple setup.

## FLIGHT PERFORMANCE

My Extra 300S weighs in at 10.5 pounds—a bit lighter than the recommended weight of 11 pounds. This provides a wing loading of around 29 ounces per square foot—not bad for this much wing area. Loaded up with 5-percent-nitro fuel and equipped with 14x8 linger prop, the Extra 300S came to life quickly.

### • Takeoff and landing

On the takeoff run, the rudder was pretty sensitive to inputs when correcting for engine torque. Make corrections gingerly, and the Extra 300S comes off the deck easily. You'll need only about 100 feet of runway, and the bird will make a smooth rotation with a steady climb-out—solid handling. We made an error when, instead of consulting the instructions, we used the fingertip balancing method to position the CG. With a CG



about 1 inch forward of where it was supposed to be, the Extra flew well until throttled back. With the CG that far forward, you will find a definite lack of elevator control at low speeds. Do read the instructions!

Landing the Extra is more complicated. It has a fast, fairly flat glide angle. Set up your approach from slightly farther away, and hold a high idle on the throttle. Once over

the end of the runway, drop the throttle and maintain a flat glide. You want to grease it to the deck, because the landing gear can bounce the plane around if you drop it in. When it's down, remember that, rolling down the runway, you have a 10.5-pound bird that will use a lot of space to stop. Don't attempt any short-field landings; otherwise, this aircraft has no nasty habits to fear.

### • High-speed handling

At high speeds, this bird comes into its own; it's smooth in the roll and pitch axes, making maneuvers a lot like those of a pattern ship. The rudder requires a little finesse owing to its sensitivity. The model accelerates quickly without changing pitch trim. Inverted flight requires a little down-elevator, and there's more than enough elevator remaining to perform outside maneuvers. Although the Extra is fast, it's large, so keeping an eye on it isn't a problem.

### • Low-speed handling

Drop the throttle on the Extra, and there are no surprises in store. The aircraft will slow gradually and predictably, and unless you feed in a handful of elevator, it will not snap over in a stall. At the point of stalling, our Extra tends to drop its right wing slightly, and a fair amount of sky is required to recover from a full stall. For deliberate stalling maneuvers, such as a spin, you will find plenty of time to select the direction of the spin before the aircraft rotates. Heavy-handed pilots are the only ones who have to worry about the Extra 300S.

### • Aerobatics

With the recommended surface throws, the Extra 300S handles well, showing moderate roll and elevator rates. Rolling is clean and axial using a little aileron differential. Loops are quite smooth, both inside and outside. The surprise again comes from the rudder. Its sensitivity allows clean, very immediate snap rolls—this from an aircraft setup that initially feels as if it won't snap roll at all! Spins are no different—quick and clean. On point rolls, you need to ease in the rudder to prevent the nose and tail from flopping around. Sustained knife-edge will require only the rudder and enough sky to maintain your smile. All in all, this Extra 300S performs like a pattern bird, except for the rudder inputs. Scale hot-doggers and pilots who wish to replicate the full-size Extra 300S will enjoy it.

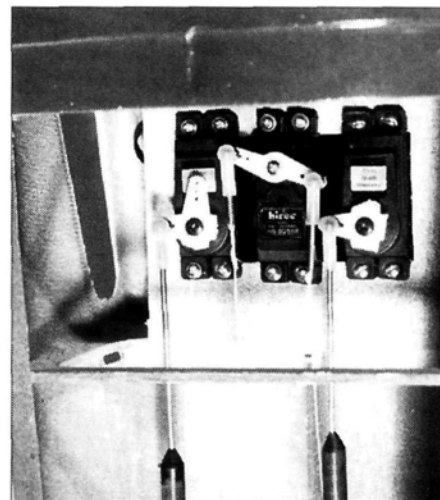
allows you to remove the entire power-plant and the fuel tank as a single unit attached to the firewall.

After the glue on former F-1 has set, install the landing-gear blocks and the tail-wheel-mount block. The landing-gear rails are reinforced with a plywood block that's not only epoxied into place, but is also held down with wood screws. It will take

quite an impact to separate the assembly from the fuselage.

### LANDING GEAR AND ENGINE MOUNT

The shape of the two-piece, aluminum, main-gear strut assembly is scale-like, with a distinctive curve. Each strut half is firmly attached to the fuselage with three wood



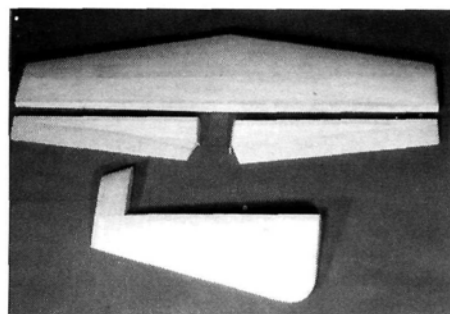
A look inside the radio compartment reveals room to spare. Hitec/RCD servos are teamed with stock Airtronics servos to provide adequate flight control. Two Hitec 605BB servos were used for ailerons and one for rudder.

screws; it would take quite a bang to knock them off. There are threaded axles at the tips, and fiberglass wheel pants cover the scale wheels. The openings for the wheels were roughly cut and needed some work to complete. The pants were easy to finish and add a great deal to the looks of the finished aircraft. A Klett steerable-tail-wheel assembly is included in the hardware package, and when mounted to the rear fuselage, it pretty much finishes off the model.

The engine mount is the famed Byron Universal Extended Motor mount. It allows the engine to be moved fore or aft and rotated to any angle you want. The system worked very well with my YS\* 1.20 4-stroke engine.

### COVERING AND FINISHING

To keep things as light as possible, I covered the Extra 300S's wings and tail surfaces with Carl Goldberg Models\* Ultracote film covering, and I painted the fuselage and wheel pants with Coverite's\* 21st Century paints. The paint matches the covering very well, and the finished model looks great.



The tail planes have been completed and are ready to be installed on the fuselage.



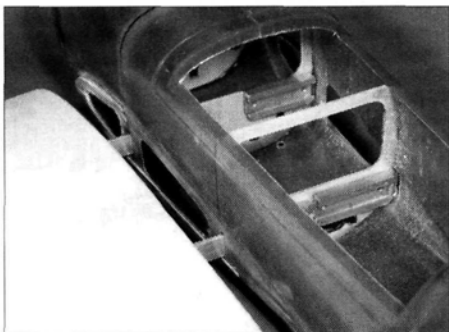
For a more scale rendition of the Extra, you'll have to paint the landing gear as well; the result is very rewarding. The only two items that detract from the model's scale lines are the YS 1.20, which pokes out through the right side of the cowl, and the cheater hole that's cut into the bottom of the cowl (this allows hot air to escape from the engine compartment).

Quite simply, the YS 1.20 is a brutal powerplant that easily powers the Extra and starts and handles very nicely.

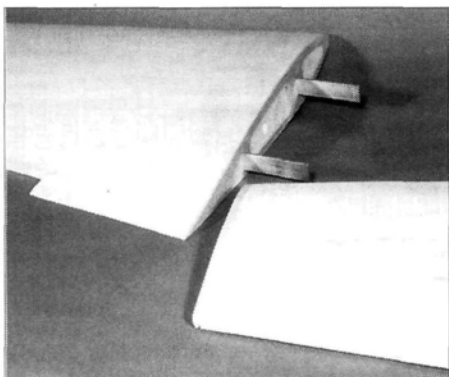
I controlled the model with an Airtronics\* Infinity 660 PCM system. With mixing, endpoint adjustment, exponential, dual rates, programmable snap roll and four-model memory, this system is more than up to the task of flying the Extra 300S. (It will also handle helis and sailplanes.) The system is easy to program, particularly because you can watch the servo react to your programming inputs. It's an outstanding, very versatile system.



*Fiberglass wheel pants not only enhance the look of the Extra 300S, but they also function to streamline the wheels.*



*Sheeted wings with joiner blades are inserted into the fuselage to align formers F-2 and F-3. This method ensures perfect wing and fuselage alignment.*



*The completed wing halves have been sheeted. The photo shows the wing-joiner blades and the flat wingtips; easy for anyone to cover.*

I also used Hitec/RCD\* HS605BB servos. With an aircraft of this size, servos of standard size are a bit nominal on power. The HS605BB servos have more than 65 oz.-in. of torque to move the various control surfaces; ball-bearing output makes their motion smooth and precise. I used one of these servos for each of the ailerons and one for the rudder. Each elevator half has one 94102 Airtronics servo controlling it; a third 94102 handles the throttle.

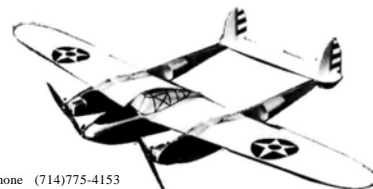
With the 2-pound YS 1.20 installed, my ship weighed in at 10.5 pounds; 4 ounces of lead were needed at the tail to balance the model as recommended in the plans. And please follow the instructions' balancing method! I figured that my standard method—finger balancing—would be just fine (after all, it has worked for decades!); well, not with this model! I was off by almost an inch, and that caused some problems. I set the surface throws at the recommended positions and filled the fuel tank.

### EXTRA EXCITEMENT

Flying the Extra 300S turned out to be a real treat. It's larger than most models and very solid in the air. With the YS 1.20 for power, the model covers ground quickly and is capable of powerful vertical climbs. This is what aerobatics is all about.

You can fly the Byron Extra 300S with less engine power and still enjoy plenty of performance; but there's nothing like making your model fly like the full-size plane. The Extra 300S is fast, snappy on command and has nothing to fear on final approach—just like the real thing. Byron has reproduced Patty Wagstaff's aircraft quite nicely. I like it—a lot! Special thanks to John and Mary Jo Mohalski on this project. Mary Jo provided me with a great deal assistance during the review.

\* Addresses are listed in the Index of Manufacturers on page 170. I



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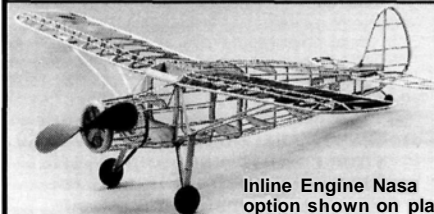
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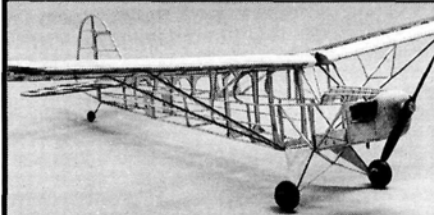
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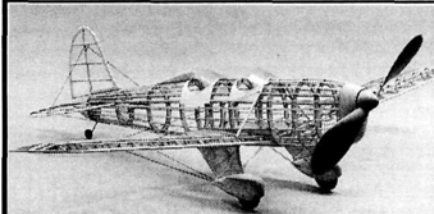
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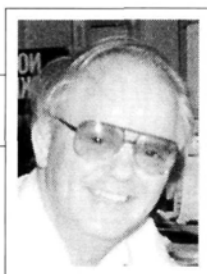
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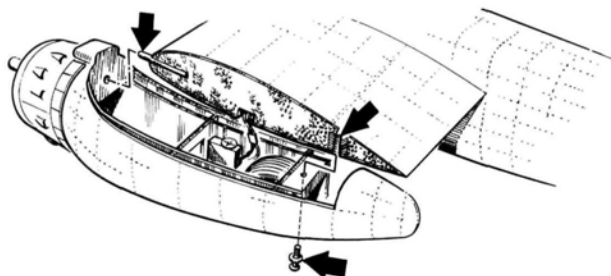
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# HINTS & KINKS

J I M N E W M A N



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## DETACHABLE NACELLES

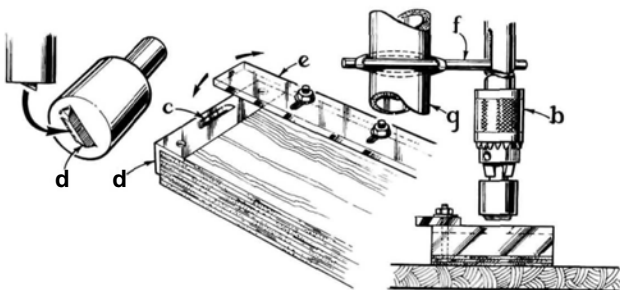
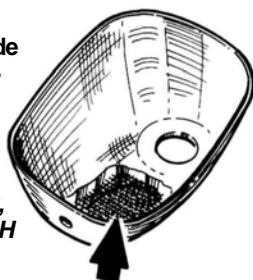
This nationally known scale winner shows us how his engine nacelles are attached in the same fashion as a fuselage is attached, but he uses a 1/4-inch-diameter (6mm) steel bolt along with the front dowel. This allows rapid access to the throttle servo, the retract unit and the tank. The bolt head is accessible through the open gear doors.

*Hal Parenti, Westchester, IL*

## AIR-INTAKE SCREEN

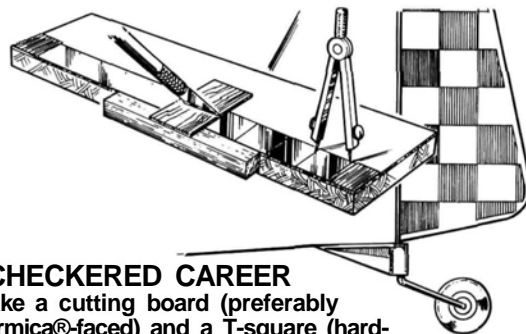
Glue regular door screening inside your cowl to keep out debris. This is especially useful for preventing small stones from being sucked into the carburetor. Chrome mesh would be a nice finishing touch, too.

*Jack Steinberger, Twinsburg, OH*



## LOUVER-PUNCHING JIG

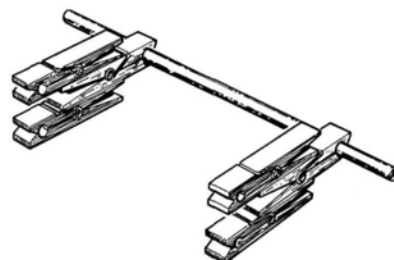
A leading British scale columnist provides this tip. Good for short production runs, this punch (a) was sawed and filed out of aluminum-bar stock, and is held in a drill-press chuck (b). The die (c) opening is drilled and filed into a piece of angled aluminum (d) that's recessed into a plywood block. The edge guide (e) can be set straight or slewed for angled louvers. The chuck is prevented from rotating by the closely fitting rod (f) that goes through the Morse Taper slot in the drill press, and is held on the pillar (g) with a rubber band. This works a treat on softened lithographic plate. Except for the shearing edge, the corners of the die opening should be gently rounded and lubricated with kerosene. Phil says, "Bring the punch down sharply." *Phil Kent, Cleckheaton, Yorkshire, England*



## CHECKERED CAREER

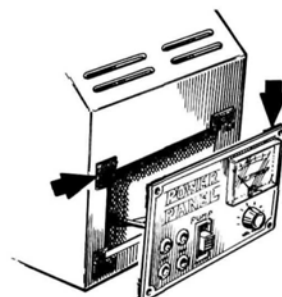
Make a cutting board (preferably Formica®-faced) and a T-square (hardwood and 1/16-inch-thick [1.5mm] birch plywood that has CA-hardened edges). Lay a sticky-back trim film strip along the edge of the board, pull it taut, and tape down the ends. Set your dividers to the width of the strip, then prick holes to show the cutting lines. Use a new blade to cut down to, but not through, the trim strip's backing paper. Lift off the squares with the point of a knife and set them into place on your model. First, swab the area with a 50:50 mixture of soap and water; it will allow you to adjust the squares before you squeegee the air and water out from underneath them. Design your scheme so that it has a base-color margin around the edge, as shown. Trim film doesn't stick well around sharp bends.

*Barrie Reaby, Black Rock, Victoria, Australia*



## EXTRA-HANDS JIG

Glue clothespins together as shown, then clamp them to a dowel or rod. This allows spacing and angles to be varied while holding down wires during soldering, etc. This would work well with the rod clamped in a Pan-a-Vise on the bench. *Frank Eason, New Bern, NC*



## QD POWER PANEL

For quick and easy battery access or repair, attach your power panel to your flight box with Velcro®-brand fasteners on each corner.

*Dwayne Schild, College Place, WA*





by MARK HOCHSTATTER

FOR THE LAST FEW YEARS, Lanier R/C\* owners, Bubba and Connie Spivey, have been expanding their successful line of Stinger kits. In 1990, the original G-62-powered Stinger was released, followed by the .120, the .10 and the .40 sizes. There's even a Stinger .60 on the way. The Stinger .40 really intrigued me; it was inexpensive to build and, more important, it didn't take up too much room in my small workshop, and it fit into my Honda CRX.

#### THE KIT

These kits don't come with hardware. I like this approach, because I often replace the supplied hardware with my own. Lanier R/C think that many modelers prefer to choose their own hardware. I agree.



# LANIER R/C *Stinger*.40

The Stinger .40 comes in a large, securely packed box. This kit has been dubbed the "BFPP" (balsa, foam, ply and plastic). The ABS plastic pieces are wrapped for protection, and the balsa parts are bundled or bagged. The full-size, rolled plans are excellent, and a manual guides you through the construction. A list of required hardware is also included, and all the building materials are of top quality.

I'm an average modeler on a budget, and I always try to follow instructions as closely as possible. I used generic glues and the hardware that was suggested in the instructions.

## A GREAT SECOND MODEL AND AEROBATIC TRAINER



PHOTOS BY MARK HOCHSTATTER & DORIS JAMES FRYKON



## THE WING

I started with the wing, because I like to get it out of the way as soon as possible. As it turned out, construction was quick and straightforward. This was my first foam-wing kit, so I had many questions about the types of glue I should use. (I'd like to thank Venture Hobby in Arlington Heights, IL, for helping me out. Support your local hobby

**Set according  
to the plans,  
the roll rate  
is nothing  
short of  
phenomenal!**

shop!) By following the instructions, I had no problems cranking out a straight wing (there's no dihedral). I may never build another all-wood wing.

Using a band saw, I cut a large notch in the center of the wing's leading edge. (The spars are made of balsa, and they fit into pre-cut notches in the foam-core.) I applied balsa sheeting and capstrips to the foam-core with 3M 77 Spray Adhesive, and I followed this with leading- and trailing-edge material. The strip ailerons are made of 1/4-inch balsa stock, and there are no wingtip blocks to add weight to the wing. The 1/16-inch balsa sheet helps to reinforce the tips, and the weight gain is negligible. The ailerons are actuated with torque wires, and the aileron servo is mounted on the top side of the center section.

## SPECIFICATIONS

**Model name:** Stinger .40

**Type:** sport mono

**Wingspan:** 48 in.

**Wing area:** 528 sq. in.

**Wing loading:** 21.8 oz./sq. ft.

**Weight:** 5 lb.

**Length:** 34 1/4 in.

**No. of channels req'd:** 4

(aileron, elevator, rudder and throttle)

**Power req'd:** .40 to .53 4-stroke  
or .32 to .46 2-stroke

**Engine used:** Magnum .46 XL

**Fuselage construction:** balsa,  
ply, ABS plastic

**Wing construction:** balsa-sheet  
foam-core and capstrips

**List price:** \$119

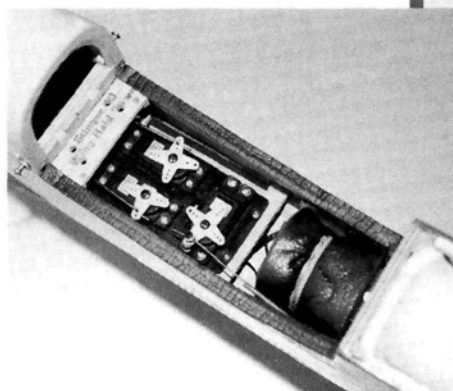
**Comments:** hefty landing gear;  
hardware is not included.

### Hits

- Good flying characteristics.
- Easy to assemble.
- ABS parts and canopy fit extremely well.

### Misses

- Instructions unclear in some areas.



*The radio compartment is snug because of the mid-wing design of the fuselage, but everything fits nicely.*

## FUSELAGE

The balsa portion of the fuselage goes together quickly. To make the bends in the aft part, score the wood and crack the side to ensure that the ABS plastic, aft turtle deck fits well. I scored the sides with a razor saw and made the crack, taking care not to break the sides completely. If you have problems, lay a piece of wood

## FLIGHT

## PERFORMANCE

Bubba Spivey says: "If the pilot can take off and land consistently without getting into trouble and breaking a prop every other landing, he'll have no problems flying this plane." When I tested the Stinger .40, I had my friend Mike Lynch fly the plane. Mike is the president of the Tri Village R/C'ers near Chicago, and he's also one of the club's instructors. After he had flown the Stinger, he agreed with Bubba. He did say that he would like to see an instructor standing by for the first few flights until the flier got used to the new plane.

### • Takeoff and landing

The magic moment made me a little nervous. I checked everything out, lined the Stinger up on the tarmac and eased the throttle forward. After a few feet, the tail lifted, and I applied some up-elevator, but the engine sagged a little, so I aborted the first takeoff. After a small engine tweak, I was off and flying! I put in a few clicks of up-trim and a few clicks of left trim, and the plane was straight and level. I made two passes around the field and handed the transmitter to Colin Cameron so that I could take some pictures. Colin is a pretty aggressive flier, and after he had landed the Stinger, he told me that I would like this plane. Dave Hasler took it up next. After a couple of circuits around the field, he flew sportsman IMAC patterns. Both pilots could not say enough good things about the Stinger. Dave did mention that on take-off, just after liftoff, it seemed to torque to the left slightly but, after that, the plane was on rails!

Dave Hasler made the first landing with the engine running well. He lined the plane up on final, and it just eased right on in. He felt that he could have taken his hands off the transmitter once the plane had been lined up. The Stinger is rock-steady! Just a little flare before touchdown to bleed off air speed, and the plane settles right down. The landing gear on this plane is very beefy, and it will take abuse, but because the plane handles so well at slow speeds, it would be hard to damage the gear.

### • High-speed performance

Here again, the Stinger is very comfortable. All control surfaces remain steady. No trim adjustments were needed when transitioning from mid-range to full throttle.

### • Slow-speed performance

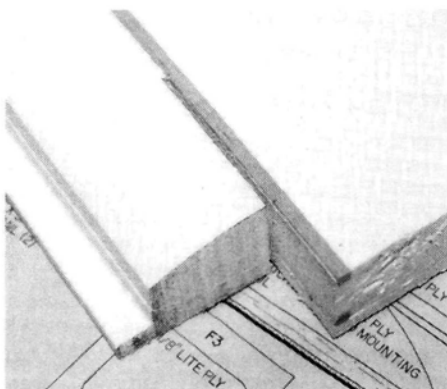
The first flight really told it all! Colin was at the sticks, and the engine was rich. The plane slowed way down with no problems and no unexpected tricks. The ailerons stayed tight with none of the mushing that other planes of this size exhibit. I experienced a couple of dead-stick landings, which were nice and slow. Stalls are almost nonexistent but, when they do occur, they're straightforward.

### • Aerobatics

Although the plane is targeted at modelers who are looking for a second plane, the Stinger .40 does it all. As you become more experienced, you can reset the aileron throws to the specifications given on the plans. You'll be very pleased with the agility of this little plane; snaps are quick, loops are tight, and inverted flight is effortless. I guarantee that the Stinger will take all you have to offer and then some!



under the scored line, and hold it in place as you press down with your thumbs. This will prevent the rest of the balsa from flexing as you make the break. When you join the fuselage pieces at the tail, find the center of F2 and F3 and mark them. These two formers make the radio compartment. Pin one end of a piece of string at the center of F2; then pull the tail sections together, and



*The center section of the wing's leading edge must be notched to mate with the fuselage. I cut my wing with a band saw.*

secure them with a clothespin. Pull the string back, align it with the center of the tail section, and adjust the tail's position (right or left) until the string lines up with the center of F3. I had a slight problem with a warp in F3. I corrected this by laminating a scrap piece of plywood to it.

## UPPER FUSELAGE

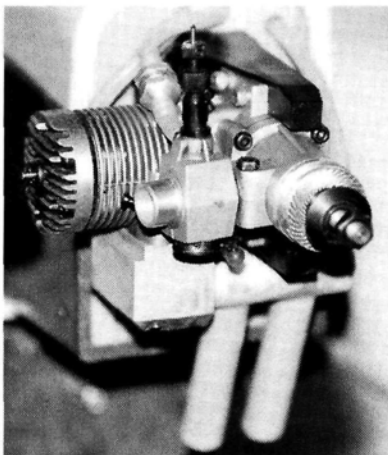
The upper fuselage comprises formed ABS plastic shells and lite-ply formers. The plastic parts are roughly cut to size and require a little trimming before they're attached to the lower fuselage. Take note that a 1/4-inch-wide apron is required on most parts and is used to secure the pieces to the top edge of the fuselage's lower portion. CA works very well for this. Be very careful when you use your Dremel tool, and wear safety glasses! I used a reinforced cut-off wheel to cut the plastic. The wheel works well in some of the tight corners. Before you make the cut, mark the cut lines with a permanent marker. After I had made the cuts, I cleaned off the marks with alcohol. I also used double-sided carpet tape to hold the parts in place while I fit them together. I was pleased that the aft turtle deck fit perfectly, as did the rest of the formed ABS parts.

In many places, the plans call for Ohio Superstar "All Threads" inserts to secure attachment screws to the fuselage. I was

unable to find these inserts at the local hobby stores, so I tried something of my own. At the hardware store, I found some small, straight, plastic drywall anchors that had ridges on them. I cut them in half and, using CA, I installed them where the plans called for the inserts. I used one size for no. 4 and no. 6 screws. The drywall anchors were inexpensive, and they worked very well.

## TAIL GROUP

The tail group is straightforward and is built using 1/4-inch-thick balsa stick construction. Built directly over the plans, the finished parts are very strong and light. The plans called for the steerable tail wheel to be mounted directly on the rudder; this could strain the rudder servo during a less than perfect landing. I made a small hook and attached it to the bottom of the rudder and used a Du-Bro\* .40-size tail-wheel bracket with a hook formed on the top wire arm. I connected the hooks with a stiff rubber band, but a small rubber O-ring works just as well. The nice thing about this kit is

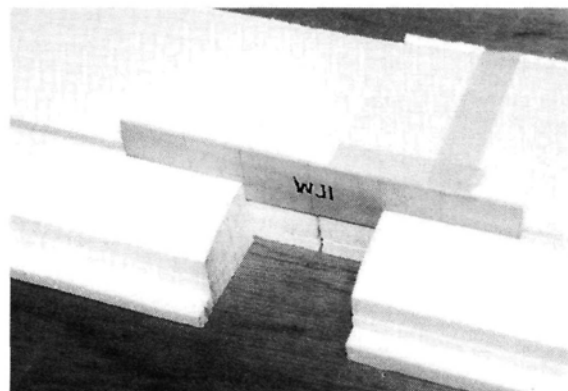


*Above: I used a Magnum .46 XL engine to power my Stinger and a Slimline Pitts muffler to improve the model's appearance. Above right: the two-piece engine cowl supplied with the Stinger .40 looks great and fits nicely.*

that you have lots of latitude, and you're only limited by your imagination when it comes to the final setup!

## RADIO AND ENGINE

I used an Airtronics\* 6-channel FM radio and four standard 102 servos. There's very little room for servo placement, so make sure that you install the servos according to the plans. Plywood rails are used to secure the servos in place. When the wing is placed in its saddle, make sure that the throttle servos don't come into contact with the wing.

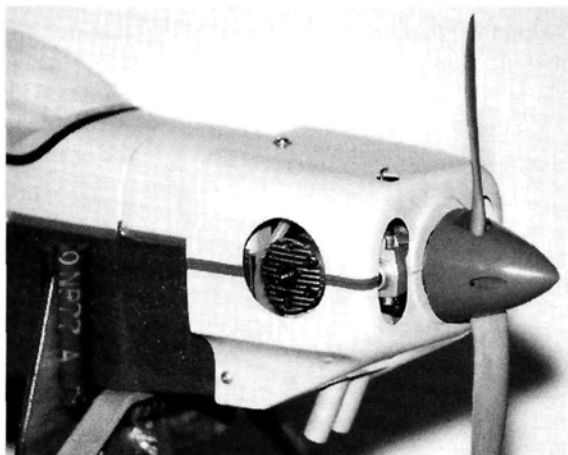


*The wing's spars are made of spruce, and a plywood wing brace strengthens the center section.*

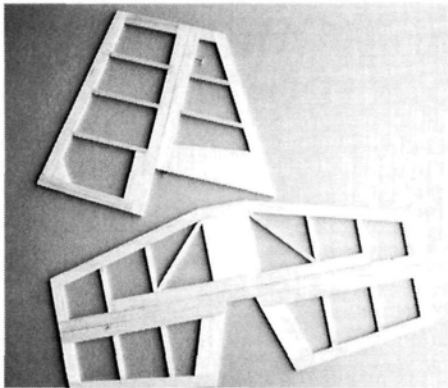
I used a Magnum .46 XL engine for this project. After breaking in the engine at a rich setting using three tanks of fuel, I leaned it out and was able to get an excellent idle and a good high-end setting. I fly using a 10x7 prop and 10-percent-nitro fuel. I also installed a Slimline\* Pitts muffler. This arrangement really looks nice!

## FINISHING

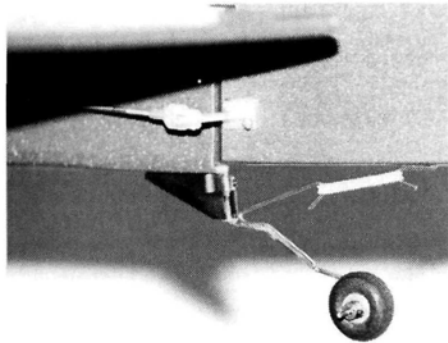
The entire plane was finished with Coverite\* 21st Century film and paint. I have a new 21st Century iron—what a joy!



Coverite's documentation says that the temperature control will hold the settings to plus or minus 3 degrees. I'm very pleased with how the iron handles. I chose a Cub Yellow and Metallic Blue color scheme, and the color match between Cub Yellow film and the paint is very close. The plastic parts are painted before they're attached to the fuselage. When I installed the tank, I dripped a small amount of the kicker onto the cover, and it darkened the paint, so be careful. The canopy is one of the easiest that I have installed, and it fits nicely. I secured it with white, flexible glue.



Built over the plans, the tail parts are very light and strong.



I isolated the tail-wheel bracket from the rudder by using a rubber band to connect the two. This prevents the shock of hard landings from being transmitted to the rudder servo.

## FINAL ASSEMBLY

With everything in place, the plane balanced on the suggested CG. The finished weight was 5 pounds even. I think the Stinger .40 is one of the most attractive models that I've seen in a long time; the wheel pants really make it look great.

I set the control throws to the suggested amounts and tested the control directions. The rudder and elevator travel shown on the plans is fine, but the suggested aileron travel is for an experienced flier. If you select the Stinger for your first aileron-equipped model, back off on the throws just a bit. Set according to the plans, the roll rate is nothing short of phenomenal!

## CONCLUSION

The Stinger .40 is marketed as a step up from a trainer. The plane is very easy to build and very attractive. I can tell that Bubba has spent a great deal of time on the Stinger .40, and this means fewer headaches for the modeler. With the .60-size coming out soon, the only thing that remains is the full-size Stinger. Maybe Bubba is working on that!

"Addresses are listed alphabetically in the Index of Manufacturers on page 170."

# NATIONAL BALSA

## BALSA WOOD STICKS

3/32	36"	48"
3 32X3 32	10	11
3 32X3 8	10	14
3 32X1/8	11	10
3 32X1-1	12	11
3 32X3 8	13	20
3 32X1	2	22
3 32X3 4	25	33
1/8	36"	48"

18X1X8	09	12
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1 8X3/16	11	15
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18X14	12	17
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1 8X3/8	13	19
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1.8X1.2	17	24
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18X3/4	27	30
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3/16	36"	48"
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3 16X3 10	12	18
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3 16X3/16	10	20
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3 16X3X8	18	20
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3 16X1/2	22	31
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3 16X3/4	30	42
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1/4	36"	48"
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1 1X1 4	19	26
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1/4X3/8	23	29
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1/4X1/2	25	35
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1 4X3/4	30	50
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1 16X2	33	44
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# HOW TO

# Rack Your Planes

Use bookshelf materials to store your models

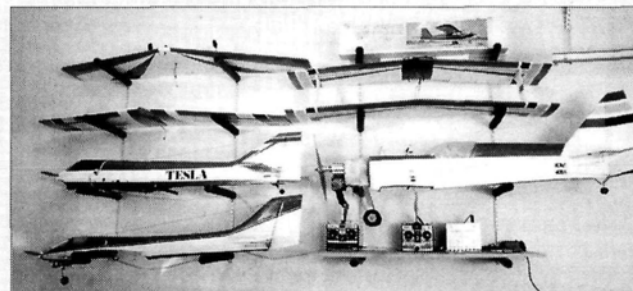
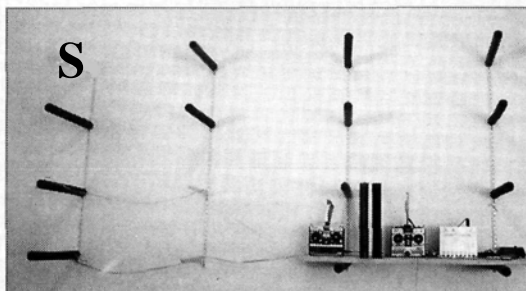
by ROBERT SUDING

FOR ABOUT \$40, you can build a simple airplane rack for your garage or basement. This double rack uses four 4-foot-long steel wall strips; 16, unpainted, 12-inch, steel bookshelf brackets; four 5-foot lengths of  $\frac{3}{4}$ -inch-thick pipe insulation; and one 12x48-inch bookshelf.

Mount the four wall strips, 32 inches on center, into the wall studs for strength. If the walls of your garage or basement are finished, use a stud finder (Radio Shack no.

64-2825 or equivalent) to carefully locate the center of each stud.

Attach the 16 brackets, and tap them to lock them into place. Cut the pipe insulation into 15-inch lengths, and push the pieces over the brackets, as shown.



Use the top brackets for storing kits, plans and your planes' wings. Place the fuselages and the bookshelf (for your transmitters or chargers) on the lower sets of brackets so that you'll be able to run charger wires to them.

Storing your models this way will minimize hangar rash, and you can customize your brackets to hold just about anything.

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# 1/4-SCALE OSAA

*Dean Lassek had the only jet: an A-10 Warthog. A pair of Dynamax fans and O.S. 91 DF engines flew this 46-pound model very nicely.*



*The Mechanical Achievement award-winning Waco BSO by John O'Brien. John even built the 5-cylinder radial engine.*



# INTERNATIONAL GIANT-SCALE

# FLY-IN

by NICK ZIROLI, SR.



*Best in Show went to Walt Moucha Sr. and Jr. for their great 1/4-scale, 12-foot-span Beechcraft D-18, which had two Quadra 100s and Robart retracts.*

**L**ATE LAST YEAR, while pondering how to use a nearly expired frequent-flier voucher, I was inspired by an ad in *Quarter Scale* magazine—the publication of the Quarter Scale Association of America (P.O. Box 13980, Las Vegas, NV 89112). The ad was for the QSAA International Fly-In in Las Vegas. I had attended this giant-scale R/C event about five years ago and thoroughly enjoyed it. It was time to go back. Las

Vegas can be great in October, and the models at the event are among the best you'll find anywhere.

This was the 18th annual Fly-In and ran from Thursday, October 20 to Saturday, October 22. Awards—and there were many—

*Skip Ruff shows off his double-size enlargement of Roy Clough's 1954 Martian Spaceship. (Skip's '91 "Model Builder" plan first appeared as a free-flight design by Roy in 1954.)*



were presented at the Saturday-night banquet. Sunday wasn't a formal Fly-In day but was set aside for taking the winners' photos at Eldorado Dry Lake—the flying site. The field was open on Sunday, but there wasn't any official frequency control. Thursday was the static-show day, with an R/C auction in the evening. The auction took place under a large tent (where there were also many vendors) at the Nevada Palace Hotel Casino, Fly-In headquarters. I felt that this was a good

location because it's

on Boulder Highway, the main road that takes you right out to the flying site.

On both Friday and Saturday, flying started at 8 a.m. and continued until about 5 p.m.

*to earned Best Multi- for his 118-inch-span ed by Zenoah G-38s. If im enlarged Nick ZirolI tan B-25 plans, which able in the future.*



*Willie Gardner's very unusual Australian Airtruck crop-duster and utility plane won the Best Static Model award; it has a 117-inch wingspan and an ST-3000 for power.*



## UNLIMITED RUNWAY

If you live on the East Coast, as I do, you won't be able to appreciate the size of the Dry Lake flying site. A large model is out of sight long before it reaches the border of the lake bed. The flying surface is smooth and flat but very hard. You can't miss the runway; it goes on for miles. There were many other activities taking place in the area. Full-scale ultralights and other planes were operating at one end of the lake, and free-flight models could just barely be seen at the other. The weather couldn't have been better. Very light winds and temperatures in the 80s prevailed throughout the entire event. It felt very good.

## GIANT-SCALE PANTHEON

The pit area was long and well laid out. About 170 scale models were present. QSAA rules state that models must have at least a 96-inch wingspan or be VA scale to be eligible. Scale is what makes this event stand out. The broad variety of subjects ranged from J-3 Cubs to a twin ducted-fan A-10 Warthog. This year, there weren't any of the super-big, giant-scale or rocket-powered models for which the QSAA is noted, but there were a good number of outstanding giant-scale aircraft on hand. This is an international event, and several models from Mexico and one from Bangkok, Thailand, were flown. Michael Hawkins won the Longest Distance Traveled award for bringing his unusual British high-altitude-aircraft model 8,279 miles from Bangkok to Las Vegas.

With 18 of them present, Spacewalkers of one size or another far outnumbered any other types of plane; Cubs of various sizes, both standard and clipped-wing, were next with 12; and Sukhoi SU-26s followed with



The expansive flight line and wide open flying area, complete with perfect weather, made this a great fly-in. The nearby Vegas strip made the nightlife interesting.



Michael Hawkins came 8,279 miles from Bangkok, Thailand, to display and fly his British high-altitude test plane.

eight. There were six Extras—230s, 260s and 300s—and a seventh that was a twin-fuselage 230 with two Dolmar 4.2s in it; it was flown by Woody Simms, who called it an "Extra 460." Five other twins were on hand, as well as three tri-motors, two Fords and a really unusual French Couzinet 70 Arc-en-Ciel (Rainbow) by Ed Hess. The Couzinet had never been flown, so it was there for static judging only. It's a 78-inch-

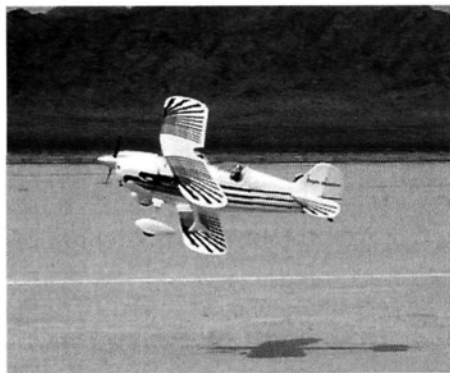
long, 147-inch-span model that's powered by three Saito FA-91 4C engines and weighs only 26 pounds.

A number of unusual and beautiful models were brought just for display. Many of the models that did fly were outstanding and put on displays that held the spectators' interest. Spectators and fliers all enjoyed the only jet present—Dean Lassek's 120-inch-span A-10 Warthog. Built from Josh Harel plans and powered by a pair of Dynamax fans with O.S. 91 ducted-fan engines, it flew very well at 46 pounds.

I like multi-engine models and was disappointed at the small turnout (five) of prop twins. There was a scratch-built, 127-inch-span P-38 by Eric Lopez, which was for display only. Woody Simms did a lot of flying with his 130-inch-span Extra 460 twin. Two Beechcraft D-18s were present. Robert Beckley had one built from my plans but, because it hadn't been test-

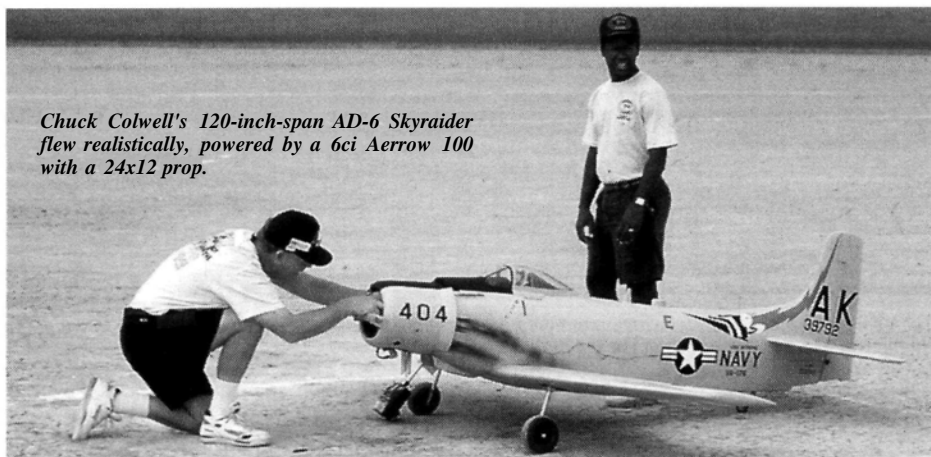
## QSAA AWARD WINNERS

Category	Winner	Plane
<b>Best in Show</b>	Walt Moucha Sr. and Jr.	<b>Beechcraft D-18</b>
Best Multi-Engine	Nick Rivaldo	North American B-25
<b>Best Biplane</b>	<b>Ken Perkins</b>	<b>Curtiss Sparrowhawk</b>
Best WW 1	Mike Brewer	Nieuport 28
<b>Best Finish</b>	<b>Gerald Scheuerman</b>	<b>Sukhoi</b>
Ed Morgan Memorial Scale	Ken Reed	1/3-scale Pitts
<b>Best Military</b>	<b>Dennis Verrill</b>	<b>F4U Corsair</b>
Best Stand-Off Scale	Judy Grigsby	Fairchild F-22
<b>Mechanical Achievement</b>	<b>John O'Brien</b>	<b>Waco BSO</b>
Powder Puff	Ruth Sharp	DH Tiger moth
<b>Junior Achievement</b>	<b>Mark West</b>	<b>Yak 55</b>
Best Scratch-Built	Noal Hess	Douglas O-46A
<b>Best Glider</b>	<b>Glenn Bennett</b>	<b>DG-500</b>
Best Static Display	Willie Gardner	Australian Airtruck
<b>Best Civilian</b>	<b>Dave Lane</b>	<b>Stinson SR-9</b>
Best Home-Built	Jim Slocum	Spacewalker
<b>Best Madera Racer</b>	<b>Woody Simms</b>	<b>P-51D Mustang</b>
Best Jet	Dean Lassek	A-10 Warthog
<b>Best Crash</b>	<b>Dennis Rollins</b>	<b>Weeks Special</b>
Marathon Flight	Bob Sloan flew 237.3 miles on V2 gallon of fuel	
<b>QSAA Hall of Honor</b>	<b>Nick Zirolli</b>	



Frank Noll put his 38-percent Christen Eagle through many vigorous aerobatics demos. Built from his Eagle Aviation Co. kit, its wingspan is 82 inches, and it's powered by a Precision Eagle 4.2.





*Chuck Colwell's 120-inch-span AD-6 Skyraider flew realistically, powered by a 6ci Aerrow 100 with a 24x12 prop.*



*Best Civilian award went to Dave Lane for his fabulous Stinson SR-9, which he built from an Ikon kit—it has an Enya VT-240 for power and is controlled by an Airtronics radio.*

flown, it was for static judging only.

QSAA regulars Walt Moucha Jr. and Sr. brought their 12-foot-span D-18—a blowup of my plan from 1/5 scale to 1/4 scale. The big model is amply powered by a pair of Quadra 100 engines. The wing chord at the fuselage is about 41 inches. Walt claims there are over 18,000 aluminum rivets (supplied by Jerry Nelson) on the model's surface. These and many other details earned the Mouchas the Best

Aviation Co. produces kits for the 38-percent Christen Eagle that he flew—and I mean flew! Frank puts on a very smooth, accurate performance. I've seen him do his thing a number of times and have always envied his flying skills. His 82-inch-span, 25-pound Eagle was guided by a Futaba radio and powered by a Precision Eagle 4.2.

Carl Hansen brought a gigantic, 133-inch-span P-26 Peashooter. This was a

Dolmar-powered Ultimate from Mexico; Sid Tanabee with his fabulous, scale, 132-inch-span Avid Magnum and 144-inch-span Avid Catalina; my good friends Bob and Alice McKay, all the way from New Jersey, with his Citabria; the list goes on and on. There were about 170 models present, so you know there had to be many outstanding ones. I wish I had room to describe them all.

**Frank Noll was on hand doing what he is so good at: aerobatics. His Eagle Aviation Co. produces kits for the 38-percent Christen Eagle that he flew—and I mean flew!**



*Woody Simms combined two Extra 230s in F-82 fashion to create an Extra 460, which has a 130-inch span and a pair of 4.2 Dolmars for power.*

in Show award. Custom-built Robart retracts and an Airtronics Vision radio are used in this outstanding D-18.

From Long Beach, CA, the final twin was Nick Rivaldo's 1 18-inch-span North American B-25. This is also an enlarged version of one of my plans—the 101-inch-span B-25. It's powered by a pair of Zenoah G-38s turning Zinger 18x8, 3-blade props. Robart retracts, an Airtronics radio and an operational bomb bay with several bomb drops all helped Nick to win the Best Multi-Engine award. I'll try to have this plan available by late 1995 or early '96.

## AEROBATICS EXHIBITION

Frank Noll was on hand doing what he is so good at: aerobatics. His Eagle

beautiful piece of work but, unfortunately, wasn't ready to fly. A 280cc engine (I don't know what brand) turning a 36x10 prop will fly this 70-pound model.

Another regular entrant, Noal Hess from Salt Lake City, LJT, flew his Douglas 0-46A observation plane (he took the Best Scratch-Built award). His plane has a 1 10-inch span and uses a

Zenoah G-62 for power. Noal also had a great 72-inch-span Boeing F4B-4 on static display.

Also in attendance were: Ken Perkins with his Curtiss F9C-2 Sparrowhawk, a 1/2-scale, 5.8-



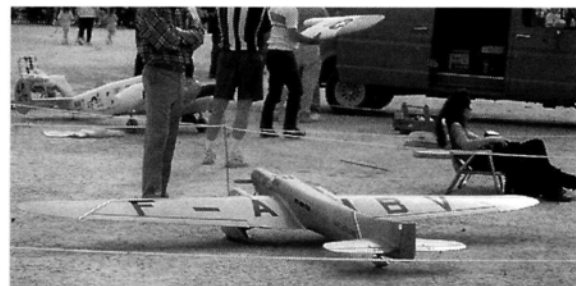
*Sid Tanabee built this 144-inch-span Avid Catalina exactly like the full-scale home-built. It has a tubular-constructed fuselage and a G-62 for power.*

## BANQUET

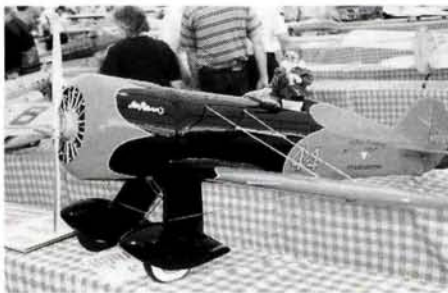
The Saturday-night banquet was held in the same tent as Thursday's static display, the vendors and Thursday evening's auction. Good food and good company made for a very pleasant evening. QSAA president Warren Cross opened the festivities



*This 110-inch-span, 37-pound Douglas 0-46A by Noal Hess won Best Scratch-Built. Noal applied a dope finish to his model, and he powers it with a G-62.*



*This unusual 1929 French tri-motor Couzinet 70 Arc-en-Ciel (Rainbow) by Ed Hess is powered by three Saito FA-91 4-cycle engines; the original was designed for transatlantic mail service.*



**Charles Murray built this beautiful Wedell Williams from Hostetler plans. His wife's grandfather was a pilot and mechanic on the plane in 1929. Number 44 won the 1933 Thompson Trophy race.**

and introduced master of ceremonies Norm Goyer, editor of *Scale R/C Modeler* magazine. The guest speaker was the very exuberant Dave Johnston, who humorously told of his efforts to fly an R/C model over the Arctic Circle. The crowd enjoyed his slides and the descriptions of the problems that he encountered in the effort.



**Best in Show went to Walt Moucha Sr. and Jr. for their great 1/4-scale, 12-foot-span Beechcraft D-18, which had two Quadra 100s and Robart retracts.**

My good friend Walt Moucha Jr. was asked to present a special award, and I was really proud when he called me to come up and accept it. I was inducted into the QSAA Hall of Honor for continued excellence in the field of giant-scale models. Thank you, QSAA; I appreciate it.

The QSAA did a good job of running a big show. The flying was well-organized, and there were no serious problems. Tony Naccarato did a fine job on the PA system; there was a variety of food and drink available in the spectator area; and many vendors were also there with hobby-related products.

If you've never been to Las Vegas and would like to spend some vacation time there, plan it around the QSAA Fly-In. It's usually held on the third weekend in October. Giant-scale models, plus the famous Las Vegas strip, add up to fun for the whole family.

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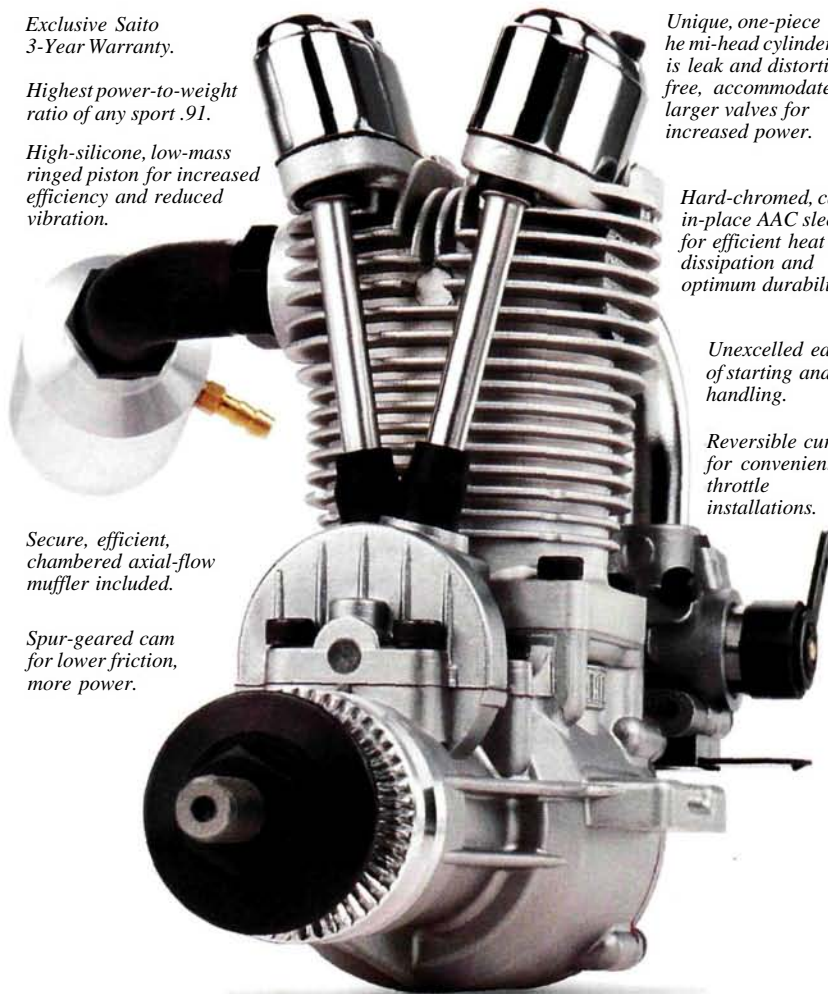
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by JIM  
SIMPSON

"VIRTUALLY

"Every part in this kit has been shaped, sawn, die-cut, laser-cut, routed, or whatever it takes

to make it ready to install right out of the box!" Thus says the statement on the box label; I didn't write it, but it's exactly what I mean to say about this kit. I've been reviewing kits for R/C magazines for more than 25 years, and this one from Sig Mfg.\* is the new standard that others should shoot for.

Like many of you, I ordered a Kadet LT-40 a long time ago when I first saw the ads. Last week, UPS delivered my kit (much to my delight) and, naturally, I tore into it. I was very impressed with what I saw. A couple of days later, my flying buddy Ted Guy received his kit and commented on its weight. Out of curiosity, we weighed it—8 pounds, 6 ounces!

As I built mine, I put all the scraps and leftovers into the box lid. Before I covered my plane, I weighed it; and then I weighed the leftovers. I figured that the difference would be accounted for by the glue that had been added and the material that had been sanded away. The plane weighed 4 pounds, and the leftovers weighed 4 pounds, 6 ounces. The difference was zero, so either the weight of the glue was equal to that of the sanded dust, or this was a lousy test!

About the only sanding that's required involves shaping the leading edges of the tail and the wingtips. I used less than 2 ounces of Satellite City\* UFO thick Hot Stuff and about 1/2 ounce of Original (thin) Hot Stuff—truly great stuff!

## EASY MODELING

If I were to write a book entitled "The Joy of R/C Model Building," I would use this kit as the subject. Simply put, one nicety followed another. I have lots of tools to make modeling easier and faster, but most of them went unused on this project. The amount of prefabrication is simply unbelievable.

Page eight of the instruction book shows the key to laser-cut parts. The plywood firewall and formers are shown with *all* the holes already cut; but, you won't appreciate that until you install the engine, the



SIG MANUFACTURING

# k a d e t LT-40

nose gear and the pushrods. Also shown on page eight are the three sizes of shear webs. In the LT-40 kit, these are precut and they fit perfectly.

## WING CONSTRUCTION

The wing is constructed of built-up balsa and spruce with center-section planking and wingtip plates (no blocks to carve). The ailerons are machine-cut, and the

Stable trainer with  
laser-cut parts  
and complete  
hardware

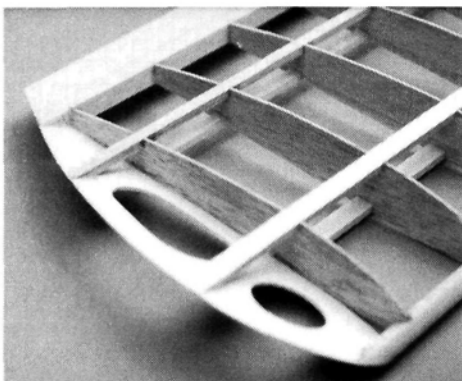


front edge is already V-shaped. All you have to do is cut the outboard end to match the wingtip angle. The

*The LT-40's wing center section. The planking is die-cut and fits perfectly.*



PHOTOS BY JIM SIMPSON

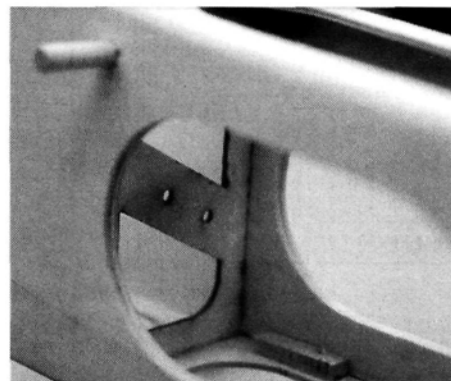


Simple design of the wingtips. No heavy sanding or forming is necessary.

Hot Stuff. The dihedral braces and center-section planking have already been cut, and they fit perfectly. The wingtip plates fit well. They're already notched, so when you glue them into place, they provide the angle against which to trim the spars, and they require very little sanding. The aileron horns are already bent and assembled; even the servo mount has already been die-cut.

### FUSELAGE CONSTRUCTION

Fuselage assembly begins with the firewall. The engine-mount holes are elongated and will accommodate any of the recommended engines.



A peek inside reveals the laser-cut holes (for the tail-surface pushrods) that are cut into the Vs-inch-ply former.

The other 11 required holes have already been laser-cut and are the correct size. The

## FLIGHT PERFORMANCE

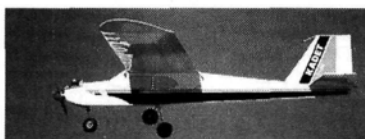
### • Takeoff and landing

We arrived at the flying field at about 10:30 a.m. on a Tuesday, and there were already more than a dozen guys flying! Ted said that they would all head home as soon as the wind came up, but neither happened. I don't like to make first flights with others around, but I had great confidence in this plane. So, after the ground pictures had been taken, I fueled up, started up, taxied out and took off. It was no problem; neither were any of the next 10 or 15 takeoffs. I even did them crosswind and downwind!

My first approach and landing was so uneventful, I made it a touch-and-go. Just for fun, I did many more the first day and was so comfortable flying this plane that I started "flaring" early and coming up with power to "drag" it in for tail-first touchdowns. The plane remained rock-steady without tip-stalling.

### • High-speed performance

Late during the second flight, I climbed up high and started a long dive toward the end of the runway. The seconds ticked by, but the plane was not building air speed and, the next thing you know, I had to hold in a little down-elevator. The plane finally got over the runway, but it didn't turn any heads as it went by. Oh, well; so much for high-speed performance! It was about half as fast as most of the sport planes at the field. But remember, it's a trainer, and it's not intended to break any speed records.



### • Low-speed performance

Great! Fun, too! Because I flew the plane with an 11x4 prop, I'm emphasizing slow-speed flight (like low gear in a car), but there's no negative side to this. Apparently, its slow-speed flight was noticeable and pleasing to most of the other fliers at the field. When we quit to go for lunch, they gathered around to "see inside" and seemed truly impressed with the LT-40's flight.

### • Aerobatics

This plane was extremely comfortable to fly and gave me no problems in any flight phase, so aerobatics just came naturally. Loops were nice and straight, and I could about double the loop sizes (from smallest to largest). Rolls were relatively slow with  $\frac{3}{8}$ -inch throws, so I added rudder commands (e.g., coordinate right rudder and right aileron) to speed them up. After a while, I enjoyed slowing them down by using only about half aileron and no rudder control. Some down-elevator is needed half-way around. Inverted flight is easy and requires some down-elevator (this is quite normal). Spin entry is crisp and rotation is quick, but recovery is immediate when the control sticks are neutralized. Altogether, it's lots of fun!

## SPECIFICATIONS

**Model name:** Kadet LT-40

**Type:** R/C trainer

**Manufacturer:** Sig Mfg. Co.

**List price:** \$104.95

**Wingspan:** 70 in.

**Wing area:** 900 sq. in.

**Weight:** 5½ to 6 lb.

**Wing loading:** 14 to 15½ oz./sq. ft.

**Airfoil type:** flat-bottom with Phillips entry

**Washout built into wing?:** no

**Length:** 56.5 in.

**Rec. engine:** .30 to .40 2-stroke; .40 to .50 4-stroke

**Engine used:** O.S.\* .40 FSR

**Prop used:** 11x4

**No. of channels req'd:** 4 (throttle, elevator, rudder, ailerons)

**Wing construction:** built-up balsa

**Fuselage construction:** die-cut lite-ply

**Features:** top-quality building materials; lite-ply fuselage construction; simple, strong wing design; computer-generated plans; photo-illustrated instructions; complete hardware package; glass-filled engine mounts; Du-Bro\* fuel tank; spinner and wheels included; wheel collars included; Sig E-Z hinges; complete pushrods; decals included.

### Hits

- Excellent flight performance.
- Great looks.
- 60-page photo-illustrated instruction book.
- Incredibly easy to build.
- Two sheets of decals and trim coloring.
- Complete hardware and accessory package.
- Uncluttered, easy-to-use plans.
- All holes pre-drilled (laser cut).

remaining formers have also been laser cut, so installation of the supplied pushrods requires no guesswork, drilling, or final adjustment. What a kit!

You completely assemble the fuselage and secure it with rubber bands before you glue anything. This provides a perfect alignment so that you can take your time as you glue each joint.

The tail surfaces are a built-up balsa framework. The critical stab center section is accurately precut, and both the elevator and the rudder—including the leading-edge vees—are already shaped.

You can block-sand the entire airframe in half an hour, and covering is a breeze. To guide you, the instruction book contains a diagram for cutting out your covering.

## FINAL THOUGHTS

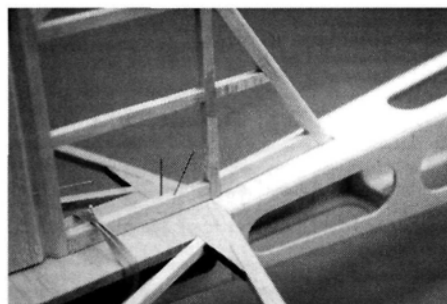
Possibly the best feature of this kit (besides its great flying characteristics) can be appreciated when final assembly begins; the kit contains everything that you'll need, and everything is usable. You



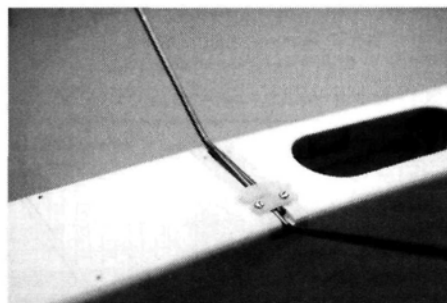
**Possibly the best feature of this kit (besides its great flying characteristics) can be appreciated when final assembly begins; the kit contains everything that you'll need, and everything is usable.**

won't waste any time searching for some little doodad; there won't be any "emergency" trips to the hobby shop at odd hours just to get an essential piece of hardware.

When you've finished the final assembly, there's a preflight checklist to guide your final preparations. It's well-thought-out and even includes recommended con-



*The LT-40's stab, fin and fuselage intersection.*



*The LT-40's main landing gear is preformed music wire that's secured in a slotted block for torsion-spring action.*

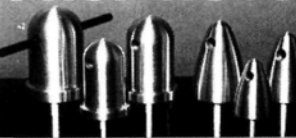
trol-surface travels. These settings are ideal for beginners and make the LT-40 a pleasure to fly. Because I have an innate desire to "hot-dog," it wasn't long before I had readjusted the amount of deflection to suit my flying style more closely. And, *wow*, does it fly well!

Next step? Well, I managed to procure a set of floats that look just right and are attached with four sheet-metal screws. I'll be flying the new LT-40 off water as soon as I mount the floats.

\* Addresses are listed alphabetically in the Index of Manufacturers on page 170.



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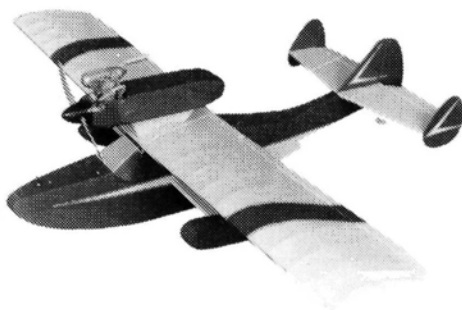
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## ENGINE REVIEW

# Tiger Shark 40A ABC

by MIKE BILLINTON

**E**VEN THOUGH they're made at a number of locations and by different engineering teams, Chinese model engines look more alike than those produced in the West. This may well be the result of differing marketing philosophies: external appearance may not matter as much in China. On the other hand, the actual differences between engines produced in the West frequently aren't as great as external variations suggest.

Although an engine's *appearance* is what first catches your attention, its *performance* is what counts. I've tested other Chinese engines—including the ASP 40 (1988)—so when testing the Tiger Shark (TSi, imported exclusively in the U.S. by ISC International) 40A ABC, I was able to assess the progress made.

Not surprisingly, the engines all have similar maximum performance levels, but the TSi 40 has *higher torque* figures at *lower rpm* (no doubt, a response to sound-level requirements worldwide).

### MECHANICAL POINTS

The TSi 40's design has much in common with R/C sport 40 engines made elsewhere, so it's strong, robust and mechanically dependable. It also has a characteristic Chinese specialty: a very secure, friction-free piston seal (a feature noted in

the ASP 40). The sturdy one-piece crankcase is further strengthened by robust boost and transfer passages and, with the piston fit already referred to, we have the essentials needed to ensure successful performance.

Added to this are a very rigid crankshaft and a well-constructed, O-ring-sealed carburetor with twin needles, so we're assured of solid, reliable operation. A useful, eye-catching, well-made, well-secured spinner/backplate assembly adds to the engine's appearance.

facturer who isn't chasing horsepower at the expense of plug life or engine reliability.

### PERFORMANCE

Half of the detailed instruction leaflet is devoted to safety, and it's vital reading for everyone, however experienced. Danger is always there, and the Tiger Shark comments are a worthwhile reminder of that.

The TSi 40A comfortably handled a large range of propellers from a Graupner 15x8 down to a Zinger 9x4, in open-exhaust configuration and fitted with a standard muffler.

This suggests the Availability of a fairly wide range of useful torque.

Break-in was the usual, swift, "ABC" affair, and the high-silicon piston never showed any sign of being tight.

### TESTS

• **Test 1. Open exhaust**—fuel, 5 percent nitro/20 percent castor oil; Model Technics medium F5 plug.

—Rpm ranged from 4,845 to 21,652.

—Torque range was wide; the graph shows that values above 70 oz.-in. were available over an unusually wide span (from 6,000 to 17,000rpm).

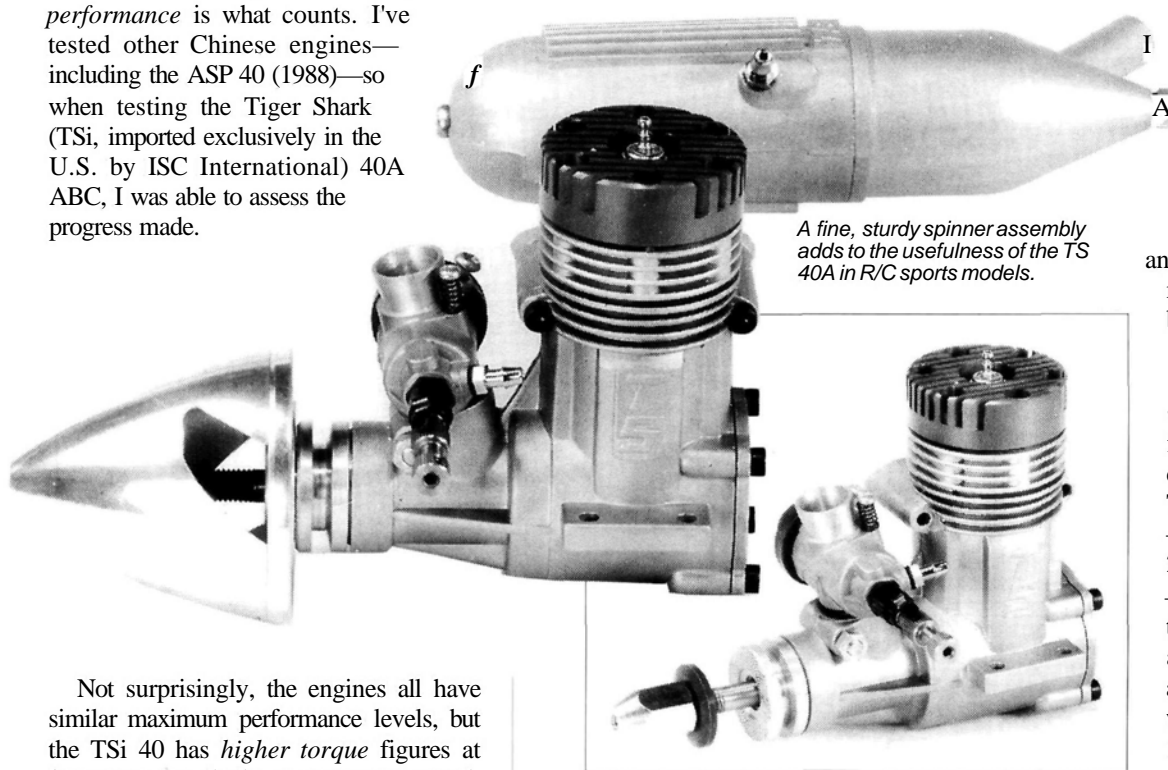
—Even at the highest rpm (19,737), torque was unexpectedly well-maintained—

above 55 oz.-in.

• **Test 2. Standard muffler**—fuel and plug as in test 1.

—This equipment led to the usual reductions in torque and horsepower.

—Fuel consumption was reasonable:



*A fine, sturdy spinner assembly adds to the usefulness of the TSi 40A in R/C sports models.*

*The TSi 40's one-piece crankcase gives good mechanical support to the "internals" (combined spinner/propeller nut shown here).*

The one-piece combustion-chamber head ensures stress-free operation: effective compression ratio—7.6:1; piston/head squish clearance—0.019 in. (almost 0.5mm) with the squish band angled upward by 10 degrees. All this suggests an engine manu-



## RPM ON STANDARD PROPELLERS

	Open exhaust	Std. muffler
15x8 Graupner	5,416	5,284
14x7 Graupner	6,179	6,179
12x11.5 C	7,139	6,624
13x6 MK	9,069	8,454
12x6 Graupner	10,123	9,444
10x9 APC	11,181	10,186
11x5 Top Flite	12,186	10,836
10x8 APC	12,264	11,060
10.5x6 Graupner	12,882	11,439
10x6 APC	14,306	12,915
10x4 Zinger	15,757	14,137
9x4 Zinger	18,704	17,313

## PERFORMANCE EQUIVALENTS

B.hp/ci	3.210	2.440
B.hp/cc	0.195	0.149
B.hp/lb	1.620	0.930
B.hp/kilo	3.560	2.050
Oz.-in./ci	196.000	175.700
Oz.-in./cc	11.960	10.720
Oz.-in./lb	98.900	66.900
ft.-lb./ci	1.020	0.920
N. meter/cc	0.085	0.077
B.hp/sq.in. (fr. area)	0.250	0.139

Manufacturer: Tiger Shark Model Co. Ltd., Block 8, Longjing Ind. Area, Manshan District, Shenzhen, China.

USA distributor: ISC International, P.O. Box 40116, Indianapolis, IN 46240; to order—(800) 332-4359; inquiries—(317) 844-1978; fax—(317) 848-1015.

UK distributor: Weston UK, 84, London Road, Teynham, Nr. Sittingbourne, Kent ME9 9QH, UK.



A ringless-aluminum-piston-in-brass-liner combo gave a very good free seal, even after the long test session.

around 17 to 18cc per minute (nearer to 22cc per minute when running slightly rich).

—Slight vibration started to be evident at approximately 16,000rpm. This seemed to be directly related to the muffler, and it was noticeable up to the maximum of 19,737rpm. The propellers recommended are 10x6 (for general sports flying) and 11x6 or so (for scale models); loads of this type will keep the engine at levels that are well below these vibration-inducing levels. —The sensible rpm area for muffler operation seems to be between 9,000 and

13,000rpm (on the ground).

• **Test 3. Sound levels**—using the standard muffler and the modified version (available from the UK's Tiger Shark distributor). Weston UK modified the muffler by adding extra baffles/chambers. As the "Sound Levels" chart shows, they have a significant effect on sound levels: at around 10,000rpm, figures were clearly below both the USA's

## TIGER SHARK 40A (ABC)

### WEIGHTS AND DIMENSIONS

Capacity	0.3928ci (6.4368CC)
Bore	0.8075 in. (20.51mm)
Stroke	0.767 in. (19.48mm)
Stroke/bore ratio	0.95:1
Timing periods	Exhaust—164° Transfer—134° Boost—124° (angled up 45°) Front induction—opens 34° ABDC —closes 48° ATDC —total period 194° —blowdown 15°
Combustion volume	0.64cc
Compression ratio	—geometric 11.05:1 —effective 7.62:1
Exhaust-port height	0.262 in. (6.65mm)
Cylinder-head squish	0.019 in. (0.48mm)
Cylinder-head squish angle	0.010°
Squish-band width	0.126 in. (3.22mm)
Carburetor bore	0.30 in (7.6mm)
Crankshaft diameter	0.5905 in. (15.01mm)
Crankshaft bore	0.375 in. (9.53mm)
Crankpin diameter	0.237 in. (6.03mm)
Crankshaft nose thread	0.246 in. x 28 TPI* (1/4 NF)
Wristpin diameter	0.197 in. (5.02mm)
Connecting-rod centers	1.377 in. (35mm)
Engine height	3.44 in. (87.3mm)
Width	2 in. (50.9mm)
Length	3.21 in. (81.5mm)
Width between bearers	1.37 in. (34.9mm)
Mounting-hole dimensions	1.74x0.70x0.146 in. (44.3x17.8x3.7mm)
Exhaust-manifold bolt spacing	1.46 in (37mm)
Frontal area	4.97 sq. in. (bare); 6.9 sq. in. (with muffler)
Weight (bare)	12.45 oz. (354g)
Weight (w/muffler and spinner)	17.9 oz. (508g)
Crankshaft weight	2.55 oz. (73g)
Piston weight	0.25 oz. (8g)
	*Threads per inch

### PERFORMANCE

Maximum B.hp	1.26 @ 18,481 rpm (open exhaust/5% nitro) 0.96 @ 19,737rpm (std. muffler/5% nitro)
Maximum torque	77 oz.-in. @ 10,700rpm (open exhaust/5% nitro) 69 oz.-in. @ 7,900rpm (std. muffler/5% nitro)

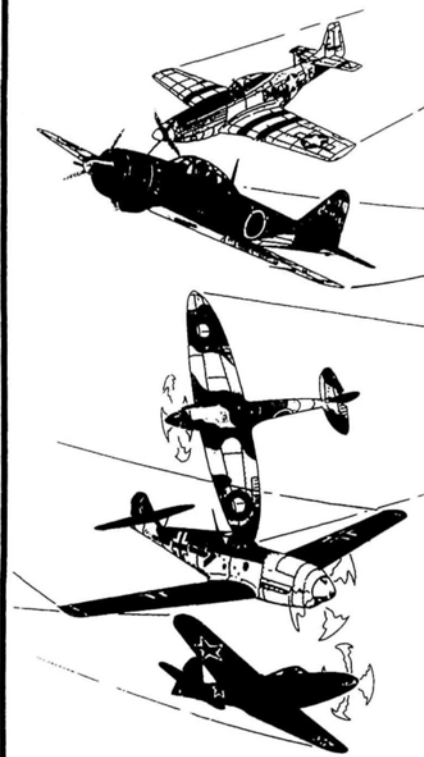
Right: Tiger Shark parts are of good quality and proved to be durable in action.



90dB at 9 feet and the UK's 82dB at 7 meters restrictions.

Going from the standard to the modified unit, I noted a 3 to 4dB reduction; readings taken at the rear of the engine revealed a surprising 7dB reduction. This

# 1/12 SCALE WARBIRDS



**NOW AVAILABLE  
EVERYWHERE  
P-51 - A6M ZERO  
SPITFIRE - BF-109  
P-63 KINGCOBRA**

All Kits require .15 to .20 engine  
**Retail Price \$59.95 ea.**

**Progressive Miniature**

214 N. Goldenrod Rd. A-16. Aviation  
Orlando, FL 32807. (407) 382-8646

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## TIGER SHARK 40A ABC

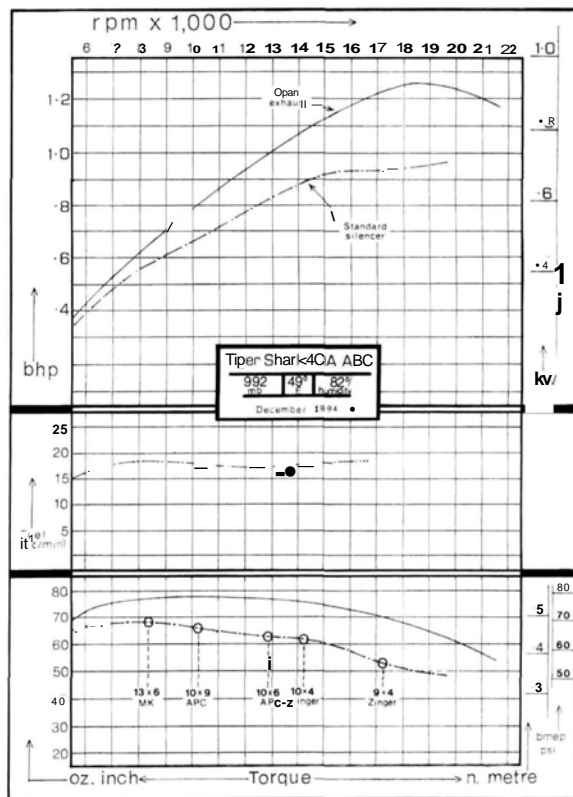
Added to this are  
a very rigid crank-  
shaft and a well-  
constructed,  
O-ring-sealed car-  
buretor with twin  
needles, so we're  
assured of solid,  
reliable operation.

proved to be the lowest figure  
reached in this series of .40  
engine tests, and it was achieved  
without rubber mountings or  
carburetor airflow mufflers.

• **Test 4. Idling.** Using the 10x9  
APC propeller, standard test  
fuel and a pressure-feed from  
the muffler to the fuel tank, I  
obtained an easy 2,150rpm  
idling figure with a good pick-  
up to max rpm after 2 minutes.

### SUMMARY

As exemplified by the TSi 40A  
ABC sports engine, China's model engine  
production lines are supplying us with very  
practical, reliable, unpretentious, low-cost  
engines. At the very least, this will put pres-  
sure on the world's established manufactur-



ers to continue their drive toward further  
sophistication and efficiency. There's more to  
be heard of this story...

### SOUND TESTS Decibel Readings

9 feet (USA/AMA)	Std. muffler 10x9 APC 10,100rpm	91	92	89	94
	Weston muffler 10x9 APC 9,960rpm	88	85	82	86
7 meters (UK)	Std. muffler 10x9 APC 10,100rpm	84	81	82	86
	Weston muffler 10x9 APC 9,960rpm	80	74	79	82

**Engine:** TSi 40A ABC

**Equipment:** standard muffler and Weston "quiet" muffler

**Fuel:** 5% nitro

**Temperature:** 49°F

**Humidity:** 82%

**Pressure:** 990 millibars

**Meter:** Radio Shack (no. 33-2050) using GA601 calibrator set to normal pressure level

**Height:** sound meter and engine set at 1 meter above concrete

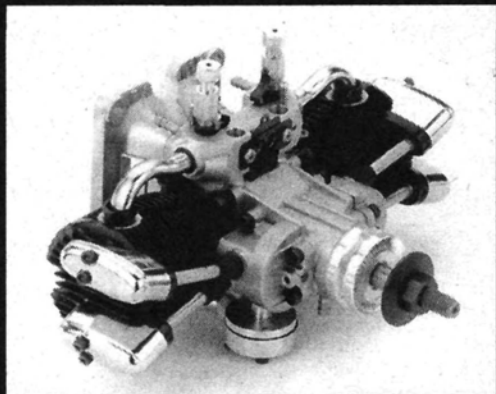
**Location:** outdoors, next to farmland

**dB**  
meter



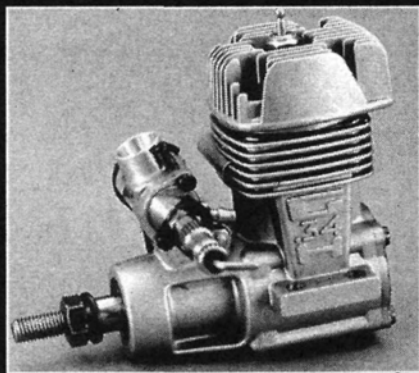
# ENGINE & ACCESSORIES BUYERS GUIDE

**W**elcome to the *Model Airplane News* "Engine and Accessories Buyers' Guide." Within, you'll find the latest releases as well as old favorites from leading engine

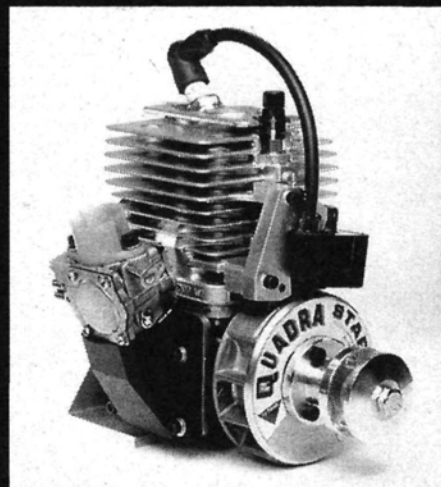


manufacturers; and there are comprehensive listings of all types of engine accessories such as pipes, props and motor mounts. In addition, this

guide includes detailed product information on radios and electronics, fuel and field accessories, tools, building and



covering materials and even electric motors and drive systems. If you're contemplating the purchase of any R/C flying-related item, you owe it to yourself to peruse this guide: you might find exactly what you're looking for.





## ENGINES

### GLOW

#### HOBBY CLUB



#### Cipolla Engines

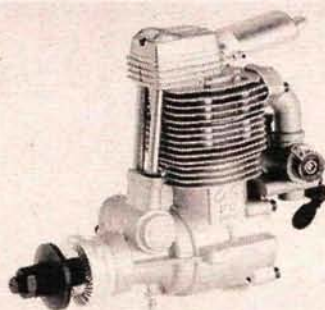
The Elite .09ci, 2-stroke engine is strong and dependable for low-cost sport flying. Features include a steel liner/aluminum piston combination; a bushing-supported crankshaft; and a blue-anodized-aluminum cylinder head. The Junior .09ci, ABC, glow-or-diesel engine is a low-cost sport engine. It features a bushing-supported crankshaft and is available in R/C, free-flight or U-control versions. A muffler is optional. The Elite 0.24 ABC engine features Schneurle porting, a dual-bearing crankshaft and a standard muffler. Other engines are also available. **Price: \$59.95 to \$119.95**

#### O.S. ENGINES



#### FP Series Engines

Easy to start, break in and maintain, FP Series is the best in affordable performance for sport/trainer craft. They feature ABC construction; expansion-style mufflers with adjustable exhaust positions; and single-needle-valve, air-bleed-style carburetors for smooth acceleration, sure starting and easy adjustment. Available in seven sizes—.10, .15, .20, .25, .35, .40 and .60—the FP Series engines are backed by the O.S. 2-year parts/workmanship warranty. Part no. OSMG0110 to OSMG0160 **Price: \$89.99 to \$179.99**

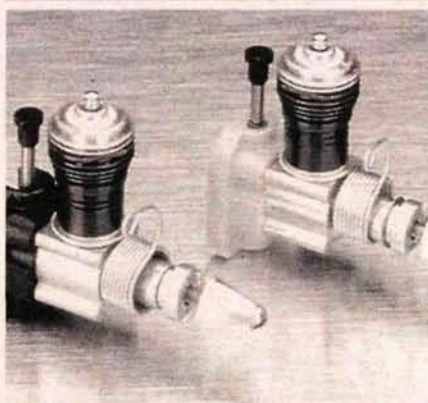


#### Surpass 4-Stroke Engines

Low noise, durability, excellent power-to-weight ratios, great fuel economy and realistic sound—as well as unquestionable O.S. quality—are all advantages of the Surpass Series engines. They feature a helix-gear-driven camshaft on the front end and updraft carbs in the back, and they include a standard silencer (except FS-26). They're available in displacements ranging from the compact .26 to the 1.20 Surpass SP supercharged. All come with a glow plug and 2-year warranty. Part no. OSMG0826 to OSMG0940 **Price: \$259.99 to \$849.99**

#### 1/2ATO .10

#### COX HOBBIES INC.



#### Killer Bee .049 and .051 Engines

Designed to run ultra-fast with high-nitro fuel on small props, these engines will clean up in Mouse Racing and Nostalgia Free-Flight. Available in .049 and .051 sizes, they're ready for class 1/2A or A competition. They feature a removable timing shim so they can also be used with lower nitro and bigger props for sport control-line or R/C flying. Extra features are the "zero-drag" starter spring, high-compression glow head and maximum-size venturi for free breathing. Cylinder and piston are taper-lapped to minimize drag at high rpm. Crankshaft fit has been relieved to suit the high performance requirements. Part no. 340 (Killer Bee .049); 360 (Killer Bee .051). **Price: call**

#### NORTHERN VELOCITY



#### AME .049 MK II

Higher performance for a lot less money! The new Northern Velocity AME .049 MK II, weighing only 1.77 ounces, is now complete with a muffler, air diffuser grid and starter spring. With Schneurle porting, hand-fitted ABN piston/cylinder and side exhaust, it has achieved 22,500rpm using a 6x3 Tornado propeller on a mix of 80-percent ethyl alcohol and 20-percent castor oil. High quality and a very low, factory-direct price make this engine a great choice for .049 high-performance fliers. Part no. .049 NO-VEL • **Price: \$33**

#### .21 TO .40

#### O.S. ENGINES



#### SX-H Heli Engines

Designed for strong, smooth running, the .61 SX-H includes strong, double-ball-bearing-supported, 9/16-inch x 24 crankshafts; a deep-dish rear cover for reduced crankcase volume and brute horsepower of 2.1 at 16,000rpm. Based on the .61, the .32 SX-H features totally new, beefed-up construction to handle its enormous power output: 18 percent greater than the .32 F-H, with the same mounting dimensions and crankshaft size for easy, direct replacement. Both are backed by a 2-year warranty. Part no. OSMG1940; OSMG1963. **Price: \$249.99; \$429.99**

#### SIG MANUFACTURING CO.

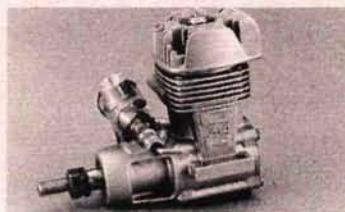


#### Rossi Engines—Sport .40

The Sport 40 is the most popular Rossi engine. With the new Super muffler, you get 1.9hp at 17,000rpm with a whisper, not a roar. Designed and built to run at the highest power level of any sport .40 production engine in the world. Backed by: Rossi warranty—3 years, all engines (against manufacturing and materials defects); Sig service—full-time repair center, prompt service with parts in stock at all times. Part no. RS16R21 to RS98R90 **Price: \$183 (RS23R40) to \$490 (RS98R90).**



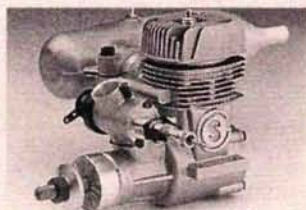
## SUPER TIGRE



### G34-H ABC

This is one of the strongest 30-class engines available. It provides precise throttle response and smooth, powerful transitions from hover to full climb while maintaining constant rpm. The G34-H produces 1.15b.hp at 16,500rpm and weighs only 12.9 ounces. Schnuerle porting, ABC-ring construction, ball bearings and a glow plug are all included. Part no. SUPG0735

Price: \$179.99



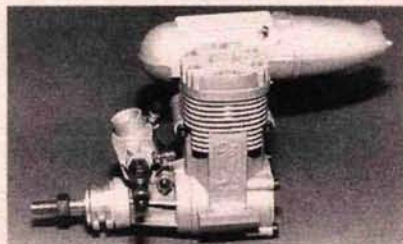
### GS-40 and GS-45

Improved porting and timing yield up to 25 percent greater power than typical sport .40s! Both include Schnuerle porting, ball bearings, lightweight cast heads and expanded-volume mufflers. The GS-40 weighs 15.97 ounces and has a 17,000 to 21,000rpm range. The GS-45 weighs 17.46 ounces and has a 2,500 to 16,000rpm range. Both are 2-year-warranty protected. Part no. SUPG0122; SUPG0150.

Price: \$209.99; \$219.99.

## .41 TO .60

### DIRECT CONNECTION R/C



### DC/SP Engines

All DC/SP engines have a true ABC cylinder and piston, dual crankcase webbing for added strength and a dual, ball-bearing-supported crankshaft. They also feature: Schnuerle boost porting; an easy-to-adjust, twin-needle, fuel-metering carb; and a squared cylinder head. The .53 offers .50-size power in a .40/.46-size case. DC/SP engines come with a 2-year limited warranty; and replacement parts are immediately available. Part no. DC/SP40; DC/SP46; DC/SP53.

Price: \$74.95; \$89.95; \$99.95.

## GERARD ENTERPRISES-MOKI



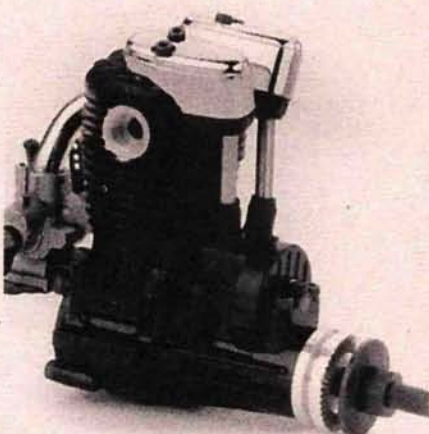
### Moki .51 Engines

Moki .51-size engines are available in both R/C and U/C. The R/C model is the ideal choice for .40-size aircraft that need the extra power that the Moki .51 can deliver. The Moki .51 U/C combines the right balance of timing parameters to give the competitive stunt flier the perfect "two-four" break, the hallmark of good stunt engines. Precision ball bearings and "old world" craftsmanship are just two of the outstanding features.

Part no. 10.51 U/C, 11.51 R/C

Price: \$314

## HORIZON HOBBY DISTRIBUTORS INC.



### FA-50 ABC 4-Stroke and FA-50GK Golden Knight

With its 3-year warranty, one-piece head and cylinder and forged chrome-moly steel cranks, the Saito FA-50 is on the leading edge of 4-stroke engine design. Producing much more thrust than weight, this little powerhouse gives a deep-throated sound that speaks of scale realism. A premium 4-stroke engine, the 50's cylinder bores are true hard chrome plated for increased durability, while its high-silicon-content aluminum pistons ensure easy start-ups. (Golden Knight version pictured.)

Part no. SAIE050; SAIE050GK

Price: \$289.95; \$304.95

## O.S. ENGINES



### .40 and .46 SF Engines

Schnuerle porting, expansion mufflers, double-ball-bearing-supported crankshafts, one-piece crankcases and a 2-year warranty make these SF Series engines a value in midsize, sport-performance airplane power. The .40 SF is available in ringed and ABC versions. The .46 SF choices include ringed and ABC versions with muffler, plus ringed and ABC engines with factory preset pumps. Part no. OSMG0242 to OSMG0248; OSMG0442 to OSMG0448.

Price: \$219.99 to 309.99

## ROYAL PRODUCTS CORP.



### .46 R/C ABC

### Schnuerle-Ported Engine

The Royal .46 engine features twin ball bearings, full fuel-metered carburetion and Schnuerle porting. It comes with a directional adjusting muffler and a tool set.

Part no. 79-651

Price: \$143.95

## .61 TO .90

## GERARD ENTERPRISES-MOKI



### Moki .61 LS Engines

Moki .61 LS engines are available in side-exhaust and rear-exhaust models. Each type is available with either ABC or ABC/Ring configuration. These 17-ounce, long-stroke engines are well suited to applications that require the use of very large props. The side-exhaust model equipped with a Bisson sport muffler will turn a 14x6 Zinger prop at 9,500rpm. The Moki .61 LS engines combine unbeatable power with very friendly handling characteristics.

Part no. 11.61, 12.61, 13.61, 14.61

Price: \$344



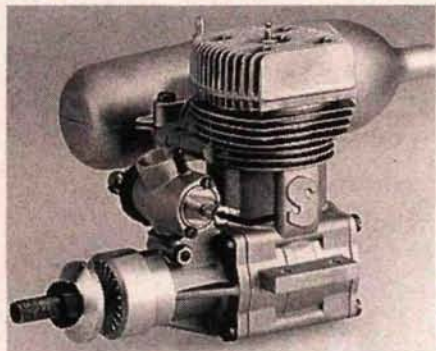
## O.S. ENGINES



### .61 RF and .61 SF Engines

The "Long Stroke" engines were designed to deliver more brute power for large-scale models and competition needs. The RF and SF engines both feature ball bearings and a muffler (except the pump-equipped versions). Also available is the .61 RF Hanno Mk II, a high-performance long-stroke type, 2-stroke engine based on Hanno Prettnier's modified engine that won the 1993 FAI World Championships in F3A Pattern Competition. All require a glow plug and are backed by a 2-year warranty. Part no. OSMG0265 to OSMG0270; OSMG0670 to OSMG0677.  
**Price: \$319.99 to \$599.99.**

## SUPER TIGRE



### S-61K, S-75K and S-90K

Available in a high-compression ABC version or ringed style with a low friction sleeve, the S-61K includes Schneurle porting, dual ball bearings, a muffler, a glow plug and a 2-year warranty. The 24.9-ounce ABC and 24.4-ounce ringed both have a 2,500 to 16,000rpm range. Both the S-75K and S-90K feature increased bore and stroke length to produce greater power from a smaller crankcase. Schneurle porting, dual ball bearings, a swing muffler and glow plug are included. The S-75K and S-90K both weigh 25 ounces and have a 2,500 to 16,000rpm range. Part no. SUPG0160 to SUPG0230.  
**Price: \$249.99 to \$309.99.**

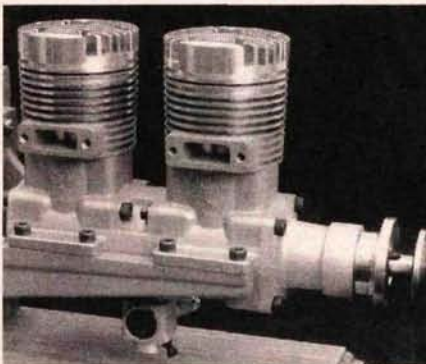
## OVER .90

### GERARD ENTERPRISES-MOKI



### Moki 1.80 Engines

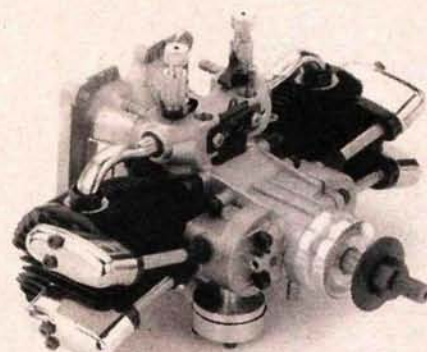
The Moki 1.80 is the most powerful engine of this displacement available. This sensational performance is nicely combined with user-friendly handling. Starting is extremely easy and predictable, and the idle is slow and smooth with none of the transition problems commonly found in other 2-stroke engines. These favorable characteristics are due to the superior design of the Moki's carburetor, and the "just right" balance of its intake and exhaust timing. Part no. 10.180  
**Price: \$476**



### Moki 3.60 Engines

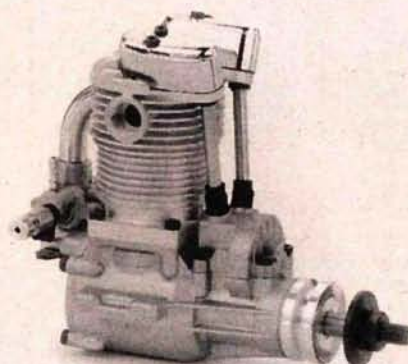
The Moki 3.60 in-line twin has one of the best power-to-weight ratios of any large-displacement model-airplane engine. This 5-pound powerhouse turns out 7.9hp with conventional exhaust systems, and over 10hp with tuned pipes. This Madera "Gold Winner" is an ideal engine for those big, heavy warbirds that need lots of power. Due to its alternate firing sequence, it's very smooth-running, with low vibration. Part no. 10.360  
**Price: \$1016**

## HORIZON HOBBY DISTRIBUTORS INC.



### SaitoFA-100T Twin R/C ABC 4-Stroke

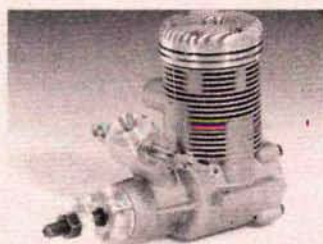
The 100-Twin is fast becoming the choice for discriminating modelers looking for instantaneous throttle response, vibration-free performance, and that realistic multi-cylinder 4-stroke roar. A perfect engine for planes in the 8 to 13-pound class, the twin has one-piece cylinders that eliminate any chance of leaking or distortion. Hemispherical cylinder heads give increased performance, while dual carbs allow precise adjustments. A cast-aluminum firewall mount is included. With a 3-year warranty, you can trust your model to the reliability of Saito. Part no. SAIE100T  
**Price: \$699.95**



### Saito FA-91S R/C AAC 4-Stroke

Built for horsepower, this engine's smoothness and performance will surprise you. Its power-to-weight ratio is head and shoulders above the popular competitors, yet it provides Saito's characteristic easy handling. A true AAC engine, special attention is given to the crank balancing, making it one of the most vibration-free 4-strokes in production. Oversize intake and exhaust valves increase performance and efficiency. Complete with Saito's 3-year warranty, the FA-91S gives your model the strength and reliability of the world's best engines, with scale sound only a 4-stroke can produce. Part no. SAIE091S  
**Price: \$419.95**





## Webra Speed 1.20

deal for overpowering your 1/4-scale aircraft, the Webra 1.20 brings easy tunability and low cost to the large-scale arena. With its larger displacement and new TNII twin-needle carburetor, the 1.20 provides 3.2hp. A one-piece pressure die-cast aluminum cylinder eliminates misalignment and distortion. Dual ball bearings and a two-year warranty round out this impressive performer. Reliability, strength and a great price make this engine a terrific value. Part no. WEBE919  
Price: \$379.95

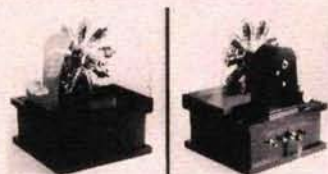
## O.S. ENGINES



## VR-DF Ducted Fan Engine

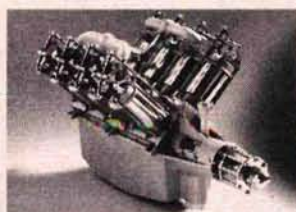
O.S. Ducted Fan Engines offer incredible performance and unsurpassed reliability. Designed to fit the popular ducted fan units, the .46, .65 and .91 VR-DF engines feature ABC piston/sleeve construction for high compression and superior output. The .46 VR-DF provides 1.9b.hp at 23,000rpm, while the .65 VR-DF provides 3.0b.hp at 22,000rpm. The .91 VR-DF delivers 4.6b.hp at 22,000rpm and is available in small- and large-head versions. Part no. OSMG1846 to OSMG1891.  
Price: \$339.99 to \$549.99.

## REPLICA ENGINES



## 1/4-Scale Gnome Rotary

The 1/4-scale Gnome Monosoupape Rotary, the first in the Famous Engine series and built to museum standards, is an outstanding example of scale modeling. Shown on its running stand, it starts and runs with the push of a button. Contained in the base are a fuel pump, electronic ignition and starter drive motor. Will operate on gasoline or glow gel. Send \$2 for brochure. Part no. GRS100  
Price: \$5200



## 1/4-Scale OX5

The fully operational 1/4-scale OX5 is available. There has never been a model engine offered that is as stunning in detail and execution. The closer you look, the more there is to see—from the ident plate with firing order to the oil-level gauge and spidery rocker arms. This is truly a spectacular engine. Production limited to 100 engines. Send \$2 for brochure. Part no. OX100  
Price: \$5500

## SUPER TIGRE



## S-2500 and S-3000K

Low in vibration and noise but high in fuel economy and power, these 2-stroke engines for giant-scale fliers feature Schneurle porting, steel cylinder sleeves, ball-bearing-supported crankshafts, cast heat-sink heads and lightweight aluminum pistons. The 44-ounce S-2500 and 43-ounce S-3000K deliver 2.8b.hp and 3.0b.hp respectively, and come with a radial mount, a glow plug and a 2-year limited warranty. Part no. SUPG0250; SUPG0265.  
Price: \$389.99; \$399.99

## MISCELLANEOUS ENGINES

## SYSTEME SOLAIRE

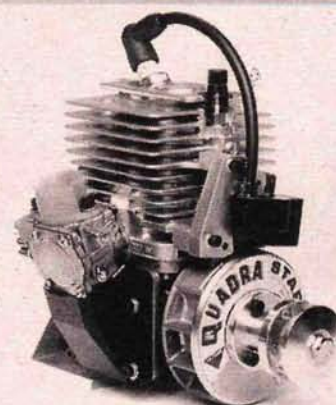


## SS67B-1

Liquid fuel rocket engine! Gasoline-powered! Completely re-usable! Can reach altitudes up to 5,000 feet! Build the revolutionary SS67B-1 liquid fuel rocket from our complete and comprehensive blueprint package. Plans include detailed drawings to construct engine, rocket casing and parachute recovery system. Package includes 16-page instruction manual and 28-page booklet with detailed assembly drawings. Complete parts and suppliers' list also included. Order by mail. Part no. SS67B-1  
Price: \$18.95

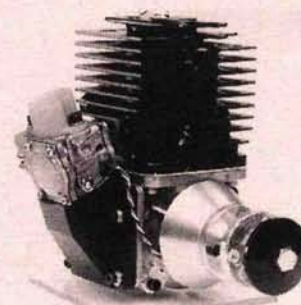
## GAS

## MROW INC.,



## Quadra Q65S

New Quadra engine from the Arrow production! Q65 Magneto; CD ignition; 65cc; 3.98ci; complete with mount, muffler and spring starter; will outperform competition; 6.8hp at 8500rpm; weight 6.4 pounds; minimum vibration; rpm range 1,500 to 10,000; recommended prop 22x12, 22x10. R/C design quality features: die-cast crankcase with integral mount; reed-valve induction, six transfer ports, rear exhaust; double web forged crankshaft; chrome-plated cylinder; single bolt prop hub (1 3/4 diameter); 1-year warranty. Available now from North American production including Q35, Q42, Q52 and Q100. Part no. 303602  
Price: \$585 (dealers may sell for less).



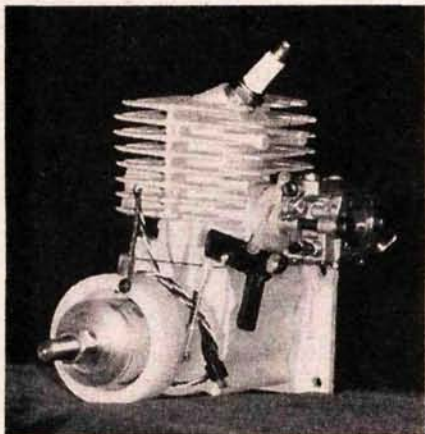
## Quadra Q75SB

This new 72cc (4.37ci) engine comes with mount, muffler and Prosparc battery ignition and will outperform the competition. Recommended prop: 22x14. It produces 8hp at 8,500rpm and weighs 5.2 pounds. It has minimum vibration, and its rpm range is 1,500 to 10,000. Quality features include: die-cast crankcase with integral mount; reed-valve induction; six transfer ports; rear exhaust; double web forged crankcase; chrome-plated cylinder; single bolt prop hub (1 3/4 diameter); 1-year warranty. Available from North American Production, including Q75S and Q75RSS for Formula One racing. Part no. 304702B  
Price: \$714 (dealers may sell for less)



## ENGINES

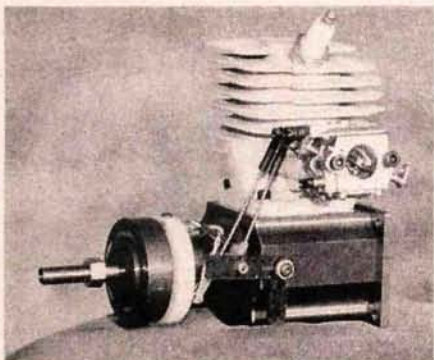
## BRISON AIRCRAFT

**Brison Model 2.4**

This engine includes: full cantilever crankshaft with single bolt prop hub (3/8-24nf thread); manual throttle couple spark advance system with C.D.I., capacity discharge ignition; Walbro carb standard equipment; drilled and tapped for smoke; blasted head and case; suitable for planes from 18 to 25 pounds depending on wing loading. Specifications: cc—39.33; height—5 1/4; length—5; width—4 3/4; weight—2 3/4; thrust—21 lb.; suggested prop—18x10, 18x8-14, 20x8.

Part no. 2.4

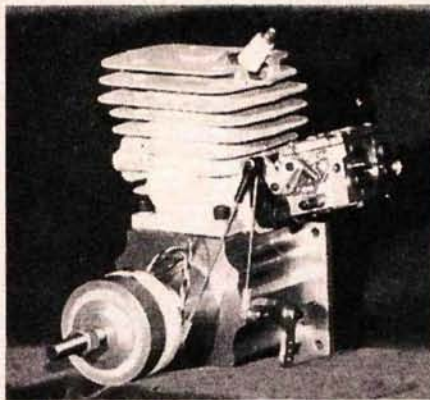
Price: \$375

**Brison Model 3.2**

This engine includes: full cantilever crankshaft with single bolt prop hub (3/8-24nf thread); manual throttle couple spark advance system with C.D.I., capacity discharge ignition; Walbro carb standard equipment; drilled and tapped for smoke; blasted head and blue-anodized case; suitable for planes from 17 to 30 pounds depending on wing loading. Specifications: cc—52.32; height—5 1/2; length—5 3/8; width—5 1/4; weight—3 1/4; thrust—26 lb.; suggested prop—20x10, 20x8-14, 22x8.

Part no. 3.2

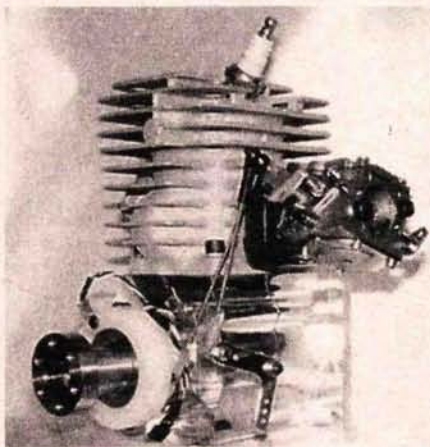
Price: \$525

**Brison Model 4.2**

This engine includes: full cantilever crankshaft with single bolt prop hub (3/8-24nf thread); manual throttle couple spark advance system with C.D.I., capacity discharge ignition; Walbro SDC80 carb standard equipment; drilled and tapped for smoke; blasted head and gold-anodized case; all-aluminum timing and throttle/carb bellcranks; no plastic; chrome-lined cylinder piston assembly by Dolmar; suitable for planes from 25 to 35 pounds depending on wing loading. Specifications: cc—69; height—5 3/4; length—6; width—6 1/8; weight—5; thrust—34 lb.; suggested prop—22x8-14, 22x12, 20x14.

Part no. 4.2

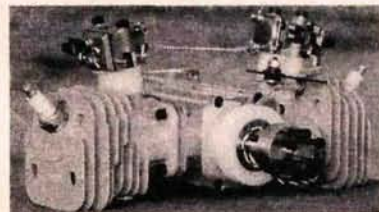
Price: \$575

**Brison Model 5.8**

This engine's features include: manual throttle couple spark advance system with C.D.I., capacity discharge ignition; cylinder/crankshaft by Dolmar; stainless-steel six-bolt hub; drilled and tapped for smoke; polished case and mount; large venturi; high fuel flow Walbro SDC80 carb standard equipment; all-aluminum bellcranks; no plastic; suitable for planes up to 45 pounds, depending on wing loading. Specifications: cc—95; height—6V2; length—53/4; width—6; weight—6; thrust—40 lbs; suggested prop—20x14, 22x14, 24x10.

Part no. 5.8

Price: \$635

**Brison Model 6.4 Twin**

This engine includes: manual throttle couple spark advance system C.D.I., ignition dual WT76 Walbro carbs; chrome lines cylinder/piston assembly by Dolmar; drilled and tapped for smoke; stainless-steel six-bolt prop hub; suitable for planes of up to 50 pounds; crankshaft and rods by Brison Aircraft with NTN deep groove roller bearings and INA caged needle bearings; one year warranty on parts and workmanship (excluding prop strikes, rubber products and crash damage). Specifications: cc—104.64; height—5V2; length—7 1/2; width—10V2; weight—7V2; thrust—45 lb.; suggested prop—22x14, 24x12.

Part no. 6.4 Twin

Price: \$950

# ENGINE ACCESSORIES

**PIPES/MUFFLERS****AEROTREND PRODUCTS****Ultra Blue Tuned-Pipe Coupler Setups**

Ultra Blue tuned-pipe coupler setup is a top quality tuned-pipe coupler at a reasonable price. It features high-performance, heavy gauge silicone that's specially formulated for tuned-pipe connections. It's highly heat resistant and strong, and it does the job. The setup includes a 4-inch piece of silicone and nylon ties, which is enough for two connections. Four sizes are available. Also available by the foot or more.

Part no. 1033 (1/2-inch i.d.); 1034 (5/8-inch i.d.); 1035 (3/4-inch i.d.); 1036 (7/8-inch i.d.).

Price: \$2.49 to \$5.49



## GERARD ENTERPRISES-MOKI



### Bisson Pitts Mufflers

Bisson Custom Mufflers manufactures an extensive line of Pitts-style mufflers for many popular 2-stroke glow and gasoline engines. These lightweight mufflers bolt directly to your engine. The sound levels range from a low of 80dBA up to 90dBA, depending on the muffler size and other variables. Bisson Pitts mufflers are made of machined aluminum, are fully welded, and will not leak. An optional smoke oil injector is available.

Price: \$32 to \$138



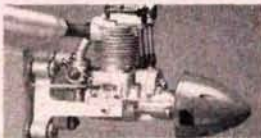
### Bisson Sport Mufflers

Bisson Custom Mufflers manufactures an extensive line of sport-style mufflers for many popular 2-stroke model engines. In most cases, these lightweight mufflers bolt directly to your engine. The sound levels for these mufflers range from a low of 80dBA up to 90dBA, depending on the muffler size and other variables. Bisson Sport Mufflers are made of machined aluminum, are fully welded, and will not leak. An optional smoke oil injector is available.

Price: \$27 to \$69

## MOUNTS

### DU-BRO PRODUCTS



### Motor Mounts

Du-Bro's patented, revolutionary designed motor mounts are very effective in reducing airframe vibration and greatly reducing fatigue on the entire airframe. They are a totally captive mount that can't debond and break free. The spool is solidly bolted to the firewall, the elastomeric rides on the spool and the sleeve that bears the engine and surrounds the elastomeric. The outer rib of the elastomeric absorbs the initial torque loads of the engine, while the inner solid portion leaves plenty of compression to effectively absorb the power impulses that cause most of the vibration. Part no. 682 (for .45 to .80 4-stroke); 684 (for .75 to 1.08 2-stroke); 686 (for .80 to .91 4-stroke); 688 (for 1.20 to 1.50 4-stroke and 1.20 to 1.80 2-stroke); 689 (eight replacement elastomeric elements for nos. 684, 686 and 688).

Price: \$27.95; \$29.95; \$31.95; \$33.95; \$10.95.

## PERFORMANCE PRODUCTS UNLIMITED

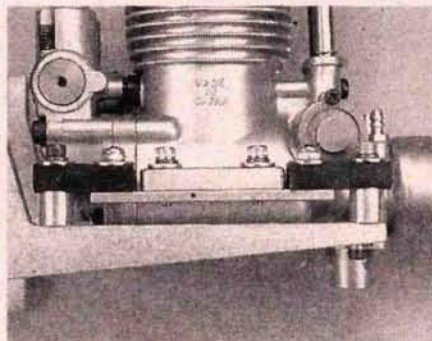


### Vibra-Damp 2-Cycle Beam Soft Engine Mount

The universal Vibra-Damp beam 2-cycle soft engine mount is for most engines up to .65ci. It's lightweight, easy to use and completely fuelproof, and it has a lifetime guarantee; reduces airframe noise and wear, increases equipment life and includes all hardware and nose limiter ring for installation. Universal engine backplate tab 2-cycle style also available, along with Performance Products' popular Beam and Tab Sport Series line. Contest-proven and laboratory-tested to achieve the maximum reduction of engine vibrational shock forces.

Part no. 1010 (beam); 1000 (tab).

Price: \$21.50



### Vibra-Damp 4-Cycle Soft Engine Mount and Aluminum T-Beam

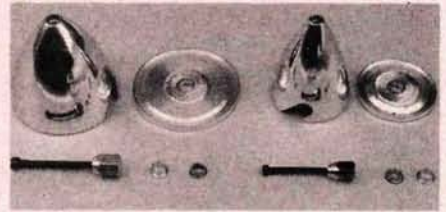
Performance Products' unique design allows for enough engine movement to give maximum damping. The aluminum T-beams allow easy installation of the Vibra-Damp 4-cycle mount to a firewall. Also unique to the Vibra-Damp 4-cycle mount is the location of the isolator bushings centered around the mass and rotational forces of the engine, eliminating the need for a nose-support ring. The mount is pre-drilled and tapped for YS and O.S. .91s and 1.20s and Saito 1.20s and 1.50s.

Part no. 1040 (mount); 1045 (T-beam).

Price: \$29.95; \$30.

## PROPELLERS/SPINNERS

### CERMARK ELECTRONIC & MODEL SUPPLY



### Spin Right Spinner

Spin Right features a complete line of aluminum spinners ranging from 1.5 inches to 6.5 inches. These spinners are lathed, machined, polished and tuned from the highest quality aluminum alloy bar stock, thus providing maximum strength, uniform shape and density at extreme rpm. Cermark also has 3- and 4-blade versions available. The newest product is Cermark's Long Nose (2.25 inches and 2.65 inches). Specific backplate, bushing and adapter nut are provided free of charge.

Price: call

## WINDSOR PROPELLER CO.



### Master Airscrew

### Classic Series Propellers

This series is for giant scale, WW II planes and other vintage aircraft (1.2 to 2.4ci engines). The Classic Series is available in 16x6, 16x8, 16x10, 18x6, 18x8, 18x10, 20x6, 20x8 and 20x10. With a wide blade and rounded tips, they're made of strong, glass-filled nylon. Ideal for use on float planes; they won't absorb water or split.

Part no. Various

Price: \$7.95 to \$15.25



### Master Airscrew G/F and K Series Propellers

Injection-molded of high-density, black, glass-filled nylon, Master Airscrew propellers have efficient, wide tips and thinner airfoil sections to provide greater thrust at a given rpm. This results in lower noise. The propellers are available in more than 35 sizes ranging from 5 inches to 15 inches in all the popular diameters; for use with 1/2A, 2- and 4-stroke engines. Newer sizes include the 9x8, 10x8 and 11x9 for quieter operation at higher pitches.

Part no. Various

Price: \$1.29 to \$7.59



## ENGINE ACCESSORIES

## WINDSOR PROPELLER CO.



### Master Airscrew Wood Series Propeller

Made of lightweight, kiln-dried beechwood in sizes of 9 to 16 inches, and of the heavier maple in 18 to 24 inches, and available in all the popular diameters. The Wood Series features the classic square tips and ample airfoil sections.

Part no. Various  
Price: \$2.10 to \$21



### Scimitar Profile Propellers

This series features a sleek scimitar shape with swept-back, narrow tips and undercambered blades. The third generation of Scimitars, this series delivers greater thrust at lower rpm—with less noise. This true competition prop is available in 17 sizes (9-inch through 13-inch diameters) with more sizes to come!

Part no. various  
Price: \$1.59 to \$2.99

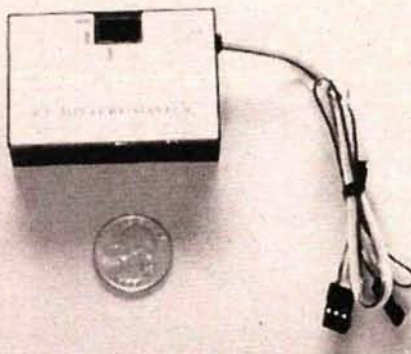


### Super K 3-Blade Component System

The Super K is the only component 3-blade system with adjustable pitch (adjustable from 4 to 13 inches). It consists of a lightweight aluminum hub, a spinner, glass-filled nylon blades and pitch adjusting gauges. Setting pitch is quick and easy. The 12-inch and 13-inch diameters are recommended for .90 to 1.20 engines. More sizes are to come! Part no. MA12SK and MA13SK  
Price: \$34.95 to \$36.95

## MISCELLANEOUS

## ADAPTIVE ENGINEERING

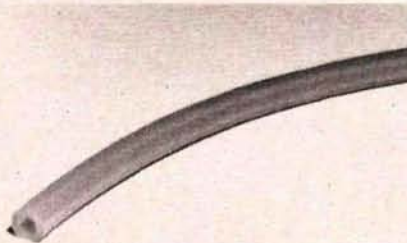


### R/C Mixture Master™

R/C Mixture Master™ continuously monitors and adjusts a glow engine's mixture to ensure peak performance. The device uses the receiver throttle and an auxiliary output to automatically control the engine throttle and mixture control/servo valve, by monitoring engine rpm and combustion temperature. Can be networked for throttle sync in multi-engine configurations. No engine modifications are necessary. The M100s includes an RS232 interface, which allows up/downloadable engine tables and parameters. Airborne weight is 2.5 ounces.

Part no. M100 (without RS232 interface); M100s (with RS232 interface).  
Price: \$99.99; \$129.99.

## AEROTREND PRODUCTS



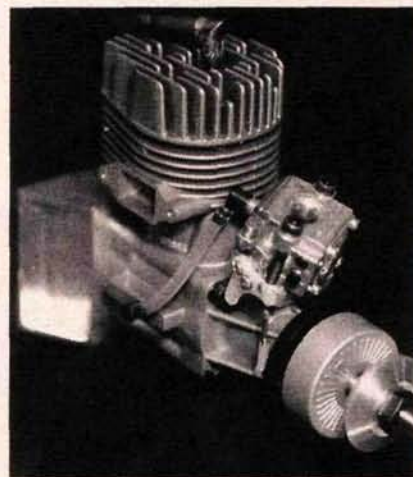
### Blue Line Exhaust Stacks

Blue Line exhaust stacks are made of silicone tubing and are formulated to keep excess residue from reaching your plane, boat, etc. Each package contains 1 foot of tubing. This tubing has high heat resistance and terrific bend.

Part no. 1023 (1/4-inch i.d.); 1024 (3/8-inch i.d.); 1025 (1/2-inch i.d.); 1026 (5/8-inch i.d.); 1027 (3/4-inch i.d.).

Price: \$2.99 to \$4.49

## C.H. ELECTRONICS



### Ignition Systems

C.H. Electronics is the oldest and largest supplier of add-on battery supported C.D. supported ignitions in the world. We have been building and flying ignition systems for 14 years. C.H. can provide you with ignition systems and parts for most of the popular 2- and 4-stroke glow engines. We have available now an American 1/4x32 spark plug. Send \$2 for current newsletter and price brochure.

## CABRAL SYSTEMS



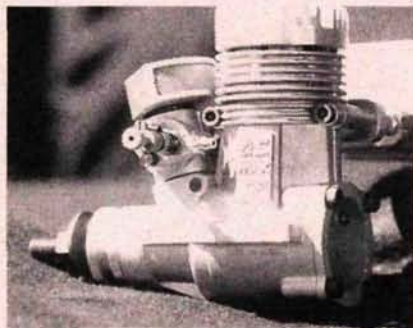
### ProSpark™ Ignitions

ProSpark™ is a digitally controlled ignition with electronically adjustable advance setting for maximum engine power. Shown is ProSpark™ for single cylinder engines using 14mm spark plugs. Converting to ProSpark™ from a magneto allows you to achieve hand starting, and a much smoother, reliable idle. Engines with mechanically advanced ignitions may be converted to ProSpark™ by locking the timing ring in place. At Madera '94, 80 percent of the Unlimited contestants and the Grand National Unlimited Gold Champion used ProSpark™, and it placed first in F1 Gold. ProSpark™ is endorsed by Aerrow Engines and Webra.

Part no. PRS14MS  
Price: \$154 (plus \$5 S&H).



## FOUNTAINHEAD ENTERPRISES



### The "Mask" Air Filter

The "Mask" air filter is a must for serious modelers interested in protecting their engine investment. Made of precision machined aluminum, with a fuel resistant foam insert to trap dust particles, and a tapered shape to deflect debris. The "Mask" air filter is available for the O.S. .46 and .61 SF for \$14.95 plus S&H. Soon for the YS120 and others. For information and orders, contact Fountainhead Enterprises.

Price: \$14.95 (plus S&H).

## METALON PRODUCTS

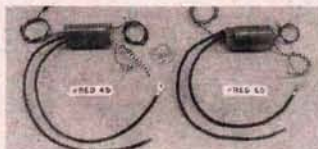


### Metalon C2

Metalon C2, 10 years later, remains the choice of champions. Engines of all sizes fueled with gasoline, diesel, glow, or "home brews" reap the benefits: increased power, greater reliability, wear reduction, longer life, no break in, no castor and fewer maintenance and storage problems. Beware: "Johnny-come-lately" products try to mimic Metalon C2. Fly with the confidence of champion pilots at Madera Air Races, Top Gun, etc. Improve the performance of your engines (helis, jets, boats, cars, vintage, sport, competition) with Metalon C2.

Price: \$12.75/8-ounce bottle.

## RAM (RADIO CONTROLLED MODELS INC.



### Igniter 1300 mA

This unit provides the dependable, low-speed engine performance of an onboard glow driver that can also start your engine—for little more than the cost of a regular Ni-Cd field starter. This igniter has a built-in 1300mAh battery that can be charged with your receiver charger. It's reversible, optically coupled, will shut down automatically and has an LED monitor. Specifications: size—1x2x11/4 inches; weight—3 ounces; Part no. RAM 50

Price: \$49.95

## TRU-TURN PRECISION MODEL PRODUCTS



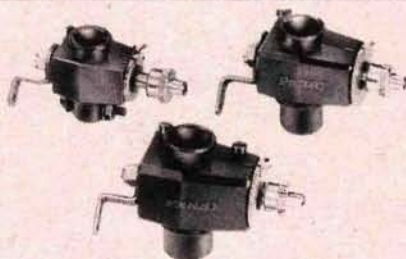
### Prop Nuts and Prop Hubs

Tru-Turn offers prop nuts in three sizes—ranging from 5/8 to 7/8 inch in diameter—and two shapes. Prop hubs are available in five sizes—from 1 to 2 inches in diameter—and two shapes.

Part no. TTN-0625-A to TTH-2000-B

Price: \$5.95 to \$21.95

## VARSANE PRODUCTS



### Perry Carburetors

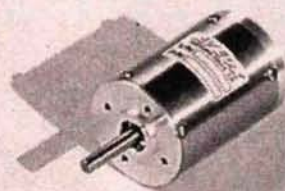
These high-performance and pump carburetors provide smooth, steady idle and transition and instant acceleration without loading your engine. Sizes: small, medium and large.

Part no. Various

Price: \$32.95 to \$39.95

# ELECTRIC MOTORS

## AVEOX INC.

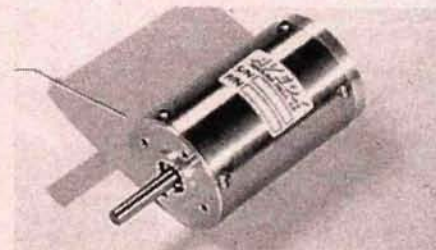


### Aveox 1409/5

This brushless motor features high-energy rare-earth magnets for increased efficiency and performance, five ABEC ball bearings, a sleeved magnet rotor and mil-spec-rated magnet wire and construction. The 1409/5 is ideally suited to airplanes running direct-drive props on seven to 10 cells. Specifications: dimensions—1.45x2.15 inches; weight—8.3 ounces.

Part no. MT00-07777

Price: \$149.95



### Aveox 1412 Series

These 1412 Series motors have the same features as the 1409 motors, but more power. The 1412/5 will swing an 11x5 prop at 8,400rpm on 10, 1000mAh cells and the 1412/7 will swing a 12.5x6 prop direct-drive at 7,500rpm on 16, 1400mAh cells. These motors are ideally suited to competition F5B performance. Specifications: dimensions—1.45x2.45 inches; weight—9.9 ounces.

Part no. 1412/5; 1412/7.

Price: \$179.95



CERMARK ELECTRONIC &  
MODEL SUPPLY**CEM-05 Cobalt Motor**

Must-see, must-have, top-of-the-line motor. CEM-05 is the best-performing motor for your money. CEM-05 uses the highest-grade samarium cobalt magnet. Streamlined and open endbell enhances cooling and reduces weight. Low-profile brush holders and caps. Straight winding provides 7 percent more power than other cobalt. Large air inlets and opened brush holders allow maximum cooling.

Part no. CEM-05

Price: \$99.95

## MAXCIM MOTORS

**Max 15 Brushless Motors**

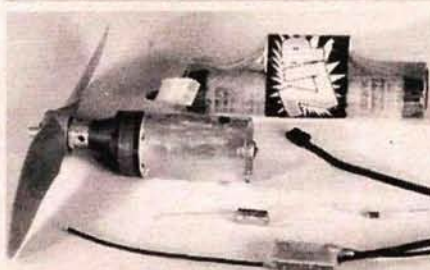
This smallest and lightest, ball-bearing, Cobalt brushless DC motor can direct-drive a 9x5 prop at 11,000rpm on 7 cells. With the available 3:1 gearbox, it spins a 14x8.5 prop at 6,600rpm on 12 cells for competition sailplanes. Use it direct-drive on planes like the Goldberg Mirage and Electri-Cub and geared on the SIG 4Star40 or Hobby Lobby Telemaster 40. Dimensions: 1.375x2.37; 7.5 oz.

Part no. Max15-13D

Price: \$175

MOTOR  
ACCESSORIES

## CLANCY AVIATION

**Lazy Bee  
Electric Power Pack**

Electric R/C flying is great, and the Lazy Bee is a wonderful electric plane. Unfortunately, the cost of "going electric" has kept some modelers from trying it. Clancy Aviation has a solution: the "Electrification Combination." For just \$86, you get a complete matched power system for the Lazy Bee: Master Airscrew .05 motor with a 3:1 gear drive, AstroFlight 217 micro speed controller, 7-cell 1300mAh Sanyo Ni-Cd battery pack and an APC 11 x7 prop.

Part no. EC-1

## MAXCIM MOTORS

**Brushless  
Motor Controller**

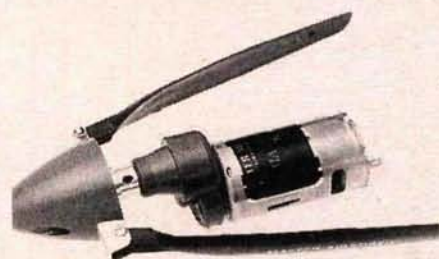
The Maxu30-16 is the first microprocessor speed control for brushless motors designed specifically for R/C model aircraft. Featuring 10kHz ultra-high pulse rate for maximum partial throttle efficiency. Auto throttle zero, 45A auto-current limiting for power and braking; jumper selectable BEC and rotation direction; rated for 30A continuous and 14 cells in a convenient in-line configuration.

Part no. Maxu30-16

Price: \$135

## GEAR DRIVES

## WINDSOR PROPELLER CO.

**Master Airscrew  
Electric Flight Pack**

This flight pack will deliver longer flight times and an improved rate of climb over direct drive. It consists of a 7.2V motor; a gearbox in a 2.5, 3.0, or 3.5:1 ratio; and a 12x8 folding prop with a spinner. Designed for 2-meter sailplanes and similar models, including sport planes. The unit comes assembled with wiring diagram instructions for each piece. Advanced electric fliers have found that this kit delivers performance comparable to cobalt systems.

Part no. MA3025K; MA3030K; MA3035K.

Price: \$39.95

**Master Airscrew  
Gearbox for 05 Motors**

This gearbox will dramatically increase performance over direct drive with longer flight times and improved climb. Features include a lightweight, compact design and high-quality gears and bearings. The rugged 3/16-inch steel output shaft is guaranteed against bending, and the 1/4-inch prop shaft will accommodate the Master Airscrew folding prop as well as the new Electric Wood Series. Fits most standard motors; the pinion gear is adaptable for Astro motors. In 2.5, 3.0 and 3.5:1 ratios.

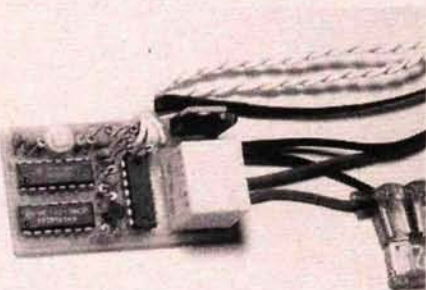
Part no. MA3025G; MA3030G; MA3035G.

Price: \$15.95



## MISCELLANEOUS

## AMERICAN PRECISION TECHNOLOGIES



## Electric Motor Controller

American Precision Technologies Inc., announces MC-2, a new electric motor controller for radio-control applications. Rugged, highly reliable, and simple to use, this product combines a Battery Eliminator Circuit with auto motor cut-off function, push-button start, remote on/off motor control, and propeller braking into a single compact unit. About the size of a servo (1.7 ounces), model MC-2 is priced at a low \$33.95. Like other APT controllers, it comes with all necessary connectors.

Part no. MC-2

Price: \$33.95

## WINDSOR PROPELLER CO.



## Electric Wood Series Propellers

The Master Airscrew Electric Wood Series is an entirely new concept for electric flight. These propellers feature wide, thin, undercambered blades for greater thrust. Available in sizes 10x6, 10x8, 11x7, 11x9, 12x8, 12x10, 13x8 and 13x10. It's a true competition prop, for electric only.

Part no. various

Price: \$4.15 to \$4.6

## TOOLS

## COVERITE



## 21st Century Iron

This space-age covering iron has a computer-chip-controlled temperature-regulating system that's accurate to within 3 degrees of the actual dial setting, making it the only iron that allows you to set the dial to an actual temperature. Designed by master modelers, it has a unique, fully contoured, scratch-resistant shoe with remarkable slip characteristics, and includes a custom-fit covering sock and a sturdy table-top stand. The "smart" iron, with artificial intelligence.

Part no. 6500 (iron); 6501 (shoe); 6502 (sock).

Price: \$39.95; \$9.95; \$2.50.



## Black Baron Iron

The Black Baron Iron's high-tech thermostat guarantees temperature drift of only 5 degrees! Conventional irons vary as much as 40 degrees. In addition, this iron has unique roll bars on the sides that fit neatly into fillets and undercambers. Its coating is 100 percent Blackstone: a big improvement in gliding capabilities over the less expensive gray coatings.

Part no. 6201 (iron); 6202 (shoe).

Price: \$23.95; \$7.95.



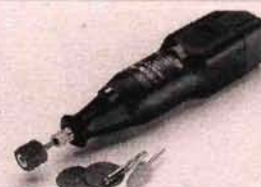
## Pocket Thermometer

This precise tool tells you the exact temperature of your iron, so you can set it correctly for covering. All of the top covering manufacturers now strongly recommend the use of this surprisingly accurate yet tiny gauge. Place it on the sole of your iron, and in about 30 seconds, the actual iron temperature is shown. Coverite's Pocket Thermometer takes the guesswork out of covering.

Part no. 6200

Price: \$7.50

## DREMEL



## MiniMite

This cordless tool allows accuracy and control. With speeds of 5,000 and 10,000rpm, the MiniMite can be used for precise drilling, sanding, shaping and grinding. It works with all 1/8-inch and smaller shank Dremel-tool bits, and it is equipped with a rechargeable, removable battery pack and a plug-in battery charger.

Part no. 750

Price: \$52.50



## Moto-Tool

The light, compact Moto-Tool operates at speeds of up to 30,000rpm. It cuts, sands, drills and polishes all kinds of material. It includes a quick-change collet nut, and it can accommodate bits up to 1/8 inch in diameter. Its tapered housing makes fingertip control comfortable. Three models are available: variable-speed, 2-speed and 1-speed. All kits include accessories and an assortment of bits.

Part no. 3950; 2850; 2750.

Price: \$136.70; \$109.10; \$75.50.

## DU-BRO PRODUCTS



## Leading Edge Trim Guide and E/Z Trimmer Master Set

The Leading Edge Trim Guide simply attaches to the E/Z Trimmer and makes trimming leading edges easier than ever. The E/Z Trimmer Master set consists of an E/Z Trimmer, a Leading Edge Trim Guide, a no. 2 X-Acto handle and four no. 19 X-Acto blades. This set allows you to trim leading edges with straight, clean and accurate cuts. Adjustable trim guide allows you to cut V16, V16, 3/16- and 1/4-inch overlaps without measuring. The clear trim guides allow you to see the knife blade while trimming. They have a smooth polished finish and won't scratch or mar covering.

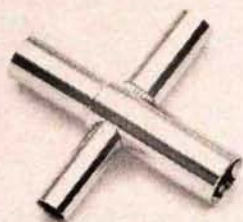
Part no. 662 (Leading Edge Trim Guide for E/Z Trimmer); 663 (E/Z Trimmer Master Set).

Price: \$1.95; \$11.95.



## TOOLS

### FOX MANUFACTURING COMPANY



#### 4-Way Wrench

No flight kit is complete without a Fox 4-way wrench. This wrench is chrome-plated and fits four different size hex sockets ( $\frac{1}{16}$  inch,  $\frac{3}{8}$  inch,  $\frac{7}{16}$  inch and  $\frac{1}{2}$  inch). Many cheap die-cast wrenches are too short to tighten a propeller securely. Our wrenches have a palm-length cross-member so you can do the job right with no more lost props in flight.

Part no. 70104  
Price: \$10.95



#### Prop Reamers

If your prop hole needs enlargement, you need a Fox prop-shaft reamer. The Fox design enlarges the hole without losing the hole position or risking splitting the prop, as a drill might do. The Fox 4-step reamer can be used in most applications. The Fox 7 and 8mm reamer will fit certain imported motors. Keep one in your flight kit.

Part no. 70201 (4-step); 70203 (7 and 8mm).

Price: \$10.95 each

### HJJ CO., INC.

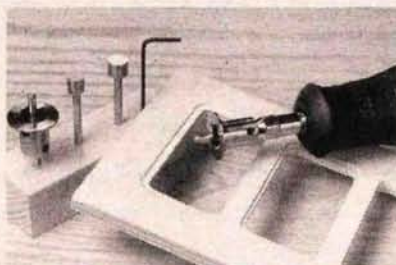


#### Non-Magnetic Screw-Holding Screwdriver

Don't drop that screw! Hang on to it with a non-magnetic HJJ screw-holding screwdriver. In one easy step, this time-saving tool firmly grips the screw head with expanding twin grips. The tool won't release the screw until the threads take hold and it is pulled free. And, of course, the screwdriver is just as efficient at removing screws from difficult spots. For slotted and cross-shaped recessed screws. Call for a catalogue.

Price: \$5.40

### JDM PRODUCTS



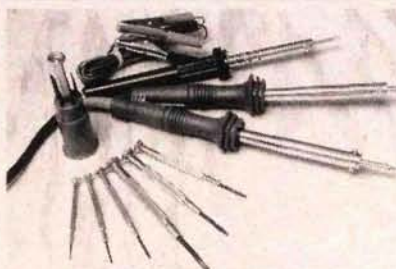
#### ROUT-A-BIT

This new freehand routing tool for all rotary hand tools lets you inlay windows, doors and hatches perfectly! Width and depth of cut are adjustable; three rabbet-cut widths:  $\frac{1}{8}$ -inch,  $\frac{1}{16}$ -inch and  $\frac{1}{32}$ -inch; routs inside and outside edges; self-cleaning action; cuts balsa, hardwood, plywood and plastic. This tool is a mini-router in itself.

Part no. 34491

Price: \$25 (plus \$1.50 S&H)

### K&S ENGINEERING



#### Modeling Tools

For your permanent or temporary fastening needs, these soldering irons and screwdriver sets are invaluable tools. In 30W AC and 12V field and 60W AC irons and 100W gun (not shown), most heat capacities are covered. The screwdriver sets come in quick-change and fixed-blade versions to meet your preference.

Part no. 212 (12V iron); 300 (30W iron); 910 (60W iron); 1210 (100W gun); 425 (Quick Change); 426 (Fixed Sets).

Price: \$5.95 to \$15.95



#### Wire Benders

The Mini Bender (shown) and the Mighty Bender bend round music wire and square or rectangular shaped metal. The Mini will handle sizes up to  $\frac{1}{8}$  inch, while the Mighty takes diameters from  $\frac{1}{8}$  inch through  $\frac{1}{4}$  inch. The Coil Winder makes quick music wire coils with up to  $\frac{3}{16}$ -inch wire. Just clamp the bases in a sturdy vise, and you're ready to bend.

Part no. 322 (Mini Bender); 323 (Mighty Bender); 324 (Coil Winder).

Price: \$9.95 to \$21.95

### NORTHWEST TOOL SUPPLY



#### Higley Tools

Northwest Tool Supply wants to be your one-stop source for Higley hand tools. Have you ever been up late at night, trying to find just the right kind of tool for a certain job? Look no more! Higley tools are designed by a modeler for modeling jobs. Northwest Tool Supply carries the complete line of Higley tools at great prices! For Higley tools, call Northwest Tool Supply. (Visa and MasterCard accepted.) Free catalogue on request.

Part no. various

Price: various



#### Minicraft Power Tools

Northwest Tool Supply wants to be your one-stop source for Minicraft precision power tools. They carry the full line of Minicraft power tools and accessories. Imported from England, these high-quality precision power tools come with a 2-year guarantee. For the finest in high-quality precision hand tools, own Minicraft. Available singly or in combination packages. Call Northwest Tool Supply today. (Visa/MasterCard accepted.) Free catalogue on request.

Part no. various

Price: various



#### Pro Plus

#### Vacuum-Bagging System

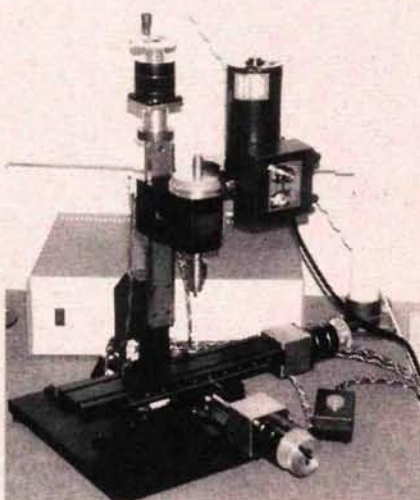
Northwest Tool Supply wants to be your one-stop source for vacuum-bagging supplies. The Pro Plus system is built around the Gast industrial vacuum pump, guaranteed for 2 full years. Included are 3 yards of bagging tube, four breather sheets, mold-release wax, bag sealant, vacuum line, a breather strip, a vacuum gauge and detailed instructions. For these and all your vacuum-bagging needs, call Northwest Tool Supply. (Visa/MasterCard accepted.) Free catalogue on request.

Part no. S 105

Price: \$249.95



## PERSONAL CNC



## 3D CNC Milling Machine

Based on the popular Sherline Deluxe Milling Machine, and using your PC, a motion control interface card is provided that accepts standard "G" code, HPGL and Excellon Drill Files. The controller is of modular design, with a separate power supply/driver/motor for each axis. Home switches, E-stop and all cabling is included. Other products, such as the Personal CNC I (\$1695), a retrofit for the Emco Maier Compact 10 & 11 Lathes, and CAD/CAM software are available.

Part no. Personal ILX

Price: \$3195

## TOP FLITE



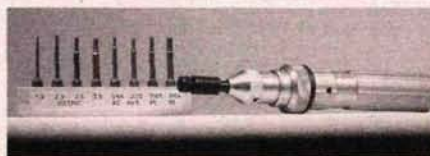
## SmartStripe

Top Flite's unique MonoKote SmartStripe lets you custom-cut precise trim stripes from MonoKote or other iron-on coverings easily and affordably. Making trim stripes from MonoKote using SmartStripe is the only way to get stripes that are as fuelproof and permanent as MonoKote covering itself. With it, you can make stripes of any width, from 1/64 inch to 5/4 inches, and you can use scraps from the same roll of covering used for your base finish to guarantee an exact color match. SmartStripe is protected by a 5-year warranty.

Part no. TOPR2420

Price: \$29.99

## TORK-IT

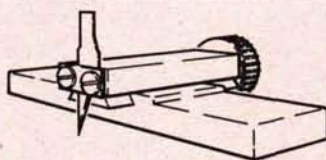
Precision  
Torque Screwdriver

Use the Tork-It Model 36 to eliminate stripped threads and minimize cylinder/head distortion caused by unevenly tightened head screws. Your engine will run better and last longer. The 2-36 inch-pound range covers all known engine applications up to 1.5ci per cylinder (except for prop nut torque). Socket-head bit sets are available in metric and U.S.

Part no. Model 36

Price: \$64.95 plus \$3.75 S&H.

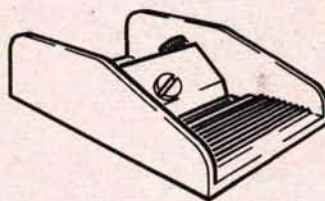
## WINDSOR PROPELLER CO.

Master Airscrew Balsa  
Stripper

Perfect for cutting cap-strips and strip stock. Each turn of the adjusting wheel advances the standard hobby blade by 1/82 inch for precision cutting. The base is marked in 1/6-inch increments, and the stripper can accommodate stock that's up to 1/4-inch thick and 1/2-inch wide.

Part no. MA4000

Price: \$4.95

Master  
Airscrew Razor Plane

The Razor Plane rounds and smoothes contours of cowlings and fuselages; it shapes edges and it thins strips. It uses a heavy-duty industrial-grade blade and is mounted with two adjustable stop screws, allowing the cutting depth to be set rigidly and accurately. The blade can easily be replaced. (Replacement blade stock no. MA4101.)

Part no. MA4100

Price: \$4.95

## RADIO

## CANNON R/C SYSTEMS

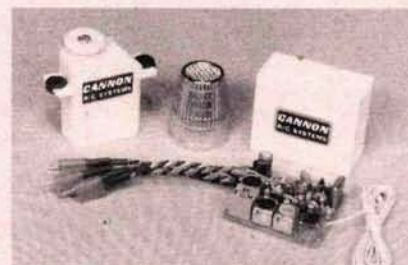


## Micro-Elite R/C System

Known worldwide as the world's smallest, lightest R/C systems. Available in 2 through 5 channels, narrow-band to AMA specs. Used for C02, electric planes, schoolyard scale, old timers, SAM contests, rocket-assist gliders, free-flight return and powered planes to .40ci. Ideal for the smallest models, especially electrics, where it performs beautifully. Detailed brochure \$1.50.

Part no. ME920-44 (4-channel)

Price: \$369.95



## Ultra-Micro R/C System

Now—the world's very smallest and lightest! (Sorry, Micro-Elite!) Comes in 2 through 5 channels. Same transmitter as Micro-Elite. Designed for indoor aircraft and blimps, but usable outdoors in small electrics and power to .15 size. Ultra does wonders for vehicles requiring smallest size and weight. Photo shows relative sizes of servos and receiver. Flite Pack (4-channel) weight, with Ni-Cd battery is only 2.3 ounces. Full description in brochure—only \$1.50.

Part no. UM920-33 (3-channel)

Price: \$309.95



## HOBBY CLUB



### CETO Radio System

Hobby Club believes that this is the smallest commercially available R/C system on the market. Designed for rudder-only control of the tiniest model aircraft, the CETO system includes transmitter, receiver, flight battery, servo and a special charging cable that allows the battery to be charged from the transmitter. Receiver dimension 19x14x10mm; weight—2 g. Maximum rudder area controllable—5 sq. cm. System comes in molded carrying case. All components available separately.

Price: \$129.95

## HORIZON HOBBY DISTRIBUTORS INC.



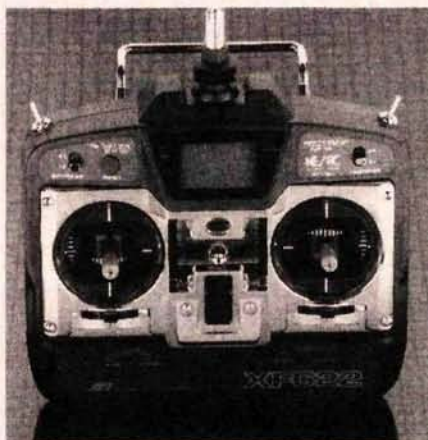
### PCM-10SX

#### Computer Radio System

Introducing the JR PCM-10SX: the successor to the World Champion PCM-10S. For helicopter refinements, JR consulted Curtis Youngblood. They included powerful additions: flight modes featuring adjustable stunt trim, revo mix and gyro sensitivity. Four mixes are multi-point programmable. For airplane refinements, JR consulted Chip Hyde, resulting in multi-point curves on three mixes, zero to 100 percent trim rates, servo speed and single-switch three-axis rate selectivity. These and other new features make JR's PCM-10SX the radio for discriminating pilots.

Part no. JRP1242 (airplane; four 517 standard servos with one ball bearing); JRP1241 (airplane; four 4131 Ultra Precision servos); JRP1246 (airplane; four 4721 Ultra Torque servos); JRP1252 (heli; five 517 standard servos with one ball bearing); JRP1251 (heli; five 4131 Ultra Precision servos); JRP1256 (heli; five 4721 Ultra Torque servos).

Price: \$1329.95; \$1549.95; \$1579.95; \$1399.95; \$1649.95; \$1689.95.



### XF622

#### Computer Radio System

Move up to a computer radio and the famous JR feel in a very affordable step. The 6-channel XF622 lets you program for both airplanes and helicopters with equal ease and authority. Two-model memory and programmable mixing mean that there's plenty of room to grow, while its dual rates, travel adjustment and other software-based features ensure flexibility. The included NER-226 FM receiver is wafer-thin, allowing easy installation. Don't settle for less; insist on the JR XF622!

Part no. JRP6210 (airplane; 4-507 standard servos); JRP6220 (helicopter; 5-507 standard servos).

Price: \$399.95; \$449.95.

## RECEIVERS

### COMMSPECTRUM, INC.



### R/C Monitor

This radio receiver has been designed to help solve the problem of radio interference at your flying area. This dual-conversion receiver clips on your belt and allows you to hear what's on your channel, allowing you to make sure your channel is clear before you fly. Contact CommSpectrum, Inc., with your channel number, and fly with confidence knowing you have no interference to disrupt your radio link.

Price: \$149.95

## SERVOS

### BODDEN MODEL PRODUCTS

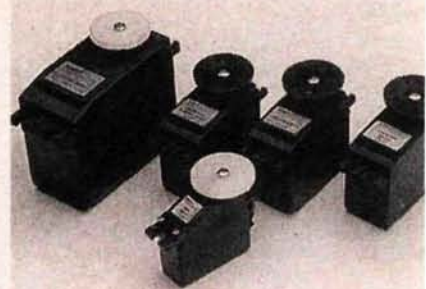


### Servo Motion Controller

BMP's Servo Motion Controller is used to control the speed of any servo. It connects between the receiver and the servo and can be adjusted for a transition speed of .4 second to 12 seconds. Great for use on mechanical retracts. It can also be used connected to the fifth channel switch. The device (BP-401) measures 1 x .65 and costs \$39.95. Call or write for more information. Part no. BP-401

Price: \$39.95

## HOBBICO



### Command Servos

Well-made and affordable, Commar Servos feature surface-mounted components plus a direct-drive potentiometer. Oil or ball bearings are standard for smooth long-lasting reliability. Two new servos recently been added to the line: the CS-63 Dual Ball Bearing and the CS-63 Low-Profile Retractable Servos. Other sizes are available to suit a wide variety of applications.

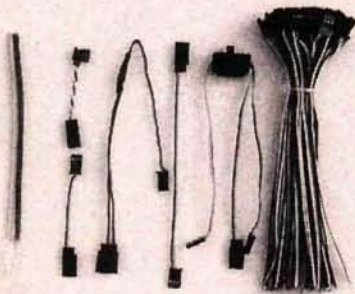
Part no. HCAM1000 to HCAM1043

Price: \$17.99 to \$59.99



## RADIO ACCESSORIES

CERMARK ELECTRONIC &  
MODEL SUPPLY J K

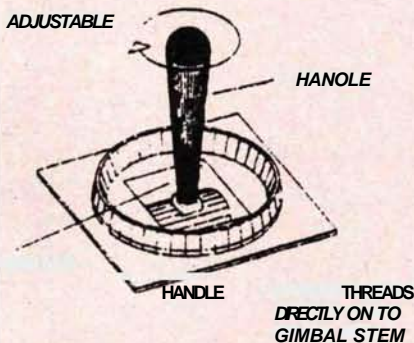


### Cermark Radio Connectors

The only full line gold-plated connectors, these gold-plated connectors are better in quality than your original Futaba, JR, Airtronics and Hitec, because the gold plating minimizes corrosion and promotes current flow. Cermark has also introduced an extra strand of wire and silicone insulation to further reduce internal resistance and enhance heat insulation. Ask for Cermark old-plated male, female, extensions, Y-harness and switches at your local dealer or directly from Cermark.

Price: call

GUIDARI R/C  
INTERNATIONAL



### Radio Extension Sticks

These double-length handles will replace your radio's existing gimbal sticks and improve flight control. With these sticks, the servo resolution is four times greater than usual and the tendency to over-control is reduced. Radio Extension Sticks work especially well with any neck- or shoulder-braced radio "steady-rest." Versions are available for most Futaba, Airtronics, Hitec and JR radios. (Save \$2 if you mention this listing when ordering.)

Part no. 1001  
Price: \$19.95

KASTNER ELECTRONIC  
DESIGNS



### The mAh Meter

The mAh meter is a precision instrument designed to record the energy usage from your battery pack. A four-digit LCD display indicates the number of milliamp hours used. It can also be used to check cell or battery-pack capacity; and servo, receiver, or transmitter power consumption. Specifications: dimensions—2.6x1.6x0.6 inches; weight—0.2-ounce; power (current) consumption—0.25mA max, 0.1 mA typical; mAh measurement range—0 to 9999mAh normal, 0 to 19999mAh extended; measured current range—0 to 2000mA.

Price: \$99.95 (\$3 S&H)

UNIVERSAL ENERGY R/C



### Alkaline Battery Back-Up System

The Alkaline Battery Back-Up System will prevent loss of your model owing to Ni-Cd battery failure. It has a 3-year shelf life and it's able to power receivers and four servos for up to 4 hours. It weighs only 5 ounces. For more information, call Universal Energy R/C Supplies. Lithium battery backup systems also available.

Part no. UE16 OF (Futaba); UE16 OJ (JR); UE16 OA (Airtronics).

Price: \$18

# ELECTRONICS

## CHARGERS

CERMARK ELECTRONIC &  
MODEL SUPPLY JUS



### CH-92 AC Multi-Charger

CH-92 is a 6-outlet multiple AC charger with Self Voltage Recognition System (each outlet can charge 1.2V to 14V at the specified current). The unit can simultaneously charge six different battery packs (receiver, transmitter, starter, Ni-starter and others). Outlet as: 500, 180, 140, 60, 60 and 50mAh (27 and 12mAh reduction resistor plug also provided).

Part no. CH-92

Price: \$35.95

HOBBICO



### Accu-Cycle Battery Analyzer

Accu-Cycle is a convenient way to cycle Ni-Cd radio-system batteries, check their condition and maximize battery performance. Accu-Cycle performs many valuable functions, including: battery charging with separately controlled charge circuits for transmitter and receiver batteries; battery conditioning to improve performance and maximize their life span; discharge capacity analysis to compare actual battery performance to its rated capacity; and discharge time analysis to estimate how much safe flight time to expect in actual use.

Part no. HCAP0260

Price: \$159.99



## ELECTRONICS

## HOBBICO

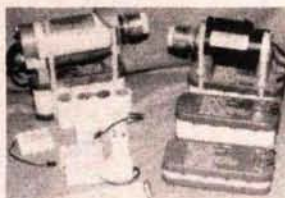
**Quick Field Charger**

Designed exclusively for charging radio batteries, this handy DC unit allows for totally independent charging of packs; you can plug in a receiver or transmitter pack without interrupting the charge cycle of a pack already attached. Special "negative" Delta Peak operation makes fast charging safer and more economical than ever. Features include a unique voltage boost circuitry to fully charge a transmitter battery from a 12V source, three LED indicators, a 90-minute time-out function for secondary protection against overcharging, and voltmeter output jacks.

Part no. HCAM3000  
Price: \$79.99

## BATTERIES

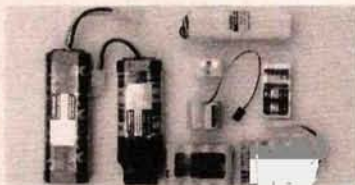
## B&amp;P ASSOCIATES

**Battery Packs for Miniature Aircraft**

B&P Associates, manufacturers of the popular 4.0Ah, 12V starter battery kits, has the great battery packs for miniature aircraft. B&P can supply you with any battery, from button-style 170mAh to 10Ah. Also available is the 2.2Ah.

Price: \$50 to \$90

## CERMARK ELECTRONIC &amp; MODEL SUPPLY

**Sanyo Battery Packs**

Sanyo, Sanyo, Sanyo, Sanyo. What else do you need to know? These packs are available for receiver, transmitter, power and others, directly from Cermark, your authorized Sanyo distributor.

Price: call

## HOBBICO

**HydriMax Nickel Metal Hydride Batteries**

These batteries bring nickel metal hydride (NiMH) technology to R/C. NiMH cells have double the energy density of Ni-Cds of the same size. They're also environmentally safe and compatible with all ESVs. NiMH batteries are available as individual, tabbed, and untabbed cells, and they come in assembled packs.

Part no. HCAP6320 to HCAP6341; HCAM6020 to HCAM6229.

Price: \$7.49 to \$9.99; \$34.99 to \$72.99.

## WINDWARD PRODUCTS

**Ni-Cd Receiver Battery Packs**

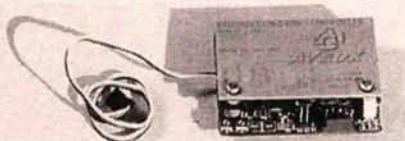
Windward Products introduces its new line of Ni-Cd receiver battery packs. Packs can be supplied to fit Futaba and Airtronics radios. Types: 300mAh square, 300mAh in-line, 500mAh 2/3 AA in-line and 500mAh AA in-line. (Available with or without connectors.)

Part no. WND43-45 Series

Price: \$10.95 to \$13.95

## SPEED CONTROLS

## AVEOX INC.

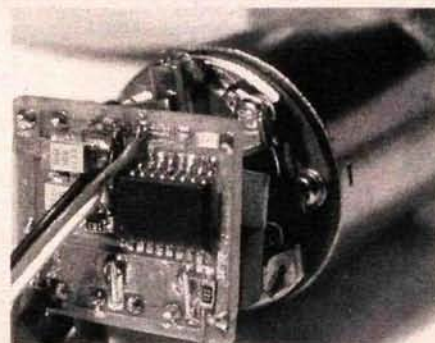
**Aveox120LV**

This controller, designed for Aveox's three-phase AC brushless motors, is ideally suited to 5- to 16-cell combinations. The 12 MOSFET controller is capable of 40A continuous and 100A peak output current. The 120LV includes a dual-color LED to simplify setup to your receiver. On-board shorting plugs allow reversing and easy activation of the zero-current motor brake.

Part no. 120LV

Price: \$249.95

## OLSON SYSTEMS

**Tiny Might Speed Control**

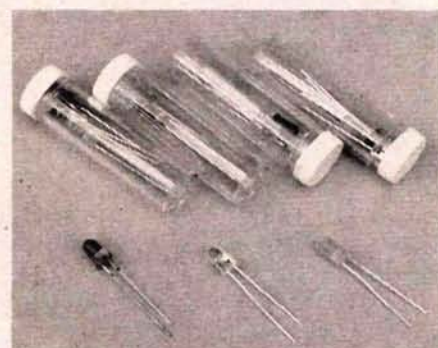
0.5-ounce 40A BEC digital high-frequency. Only 1.2x1.0x0.4-inch BEC eliminates receiver batteries. Digital Signal Processing Fail Safe shuts down motor if radio signal is lost. Auto-calibration, no switches or knobs. 0.003-ohm MOSFET array 7 to 20 cells at 400A peak, 20A continuous, 40A with air flow or optional lightweight heat sink. Total weight 0.90 ounce with 14GA wiring harness and connectors. No-risk 90-day money-back warranty. Made in the USA. Call for free brochure!

Part no. 40A BEC

Price: \$74.95

## LIGHTS/SOUNDS

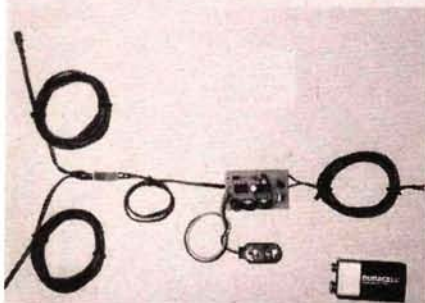
## CERMARK ELECTRONIC &amp; MODEL SUPPLY

**Self-Blinking LED**

Where is your airplane? With these three bright self-blinking LEDs, you won't have a problem picking up your plane against a darkening background. Each blinking LED (red, green, clear) is a self-contained unit with its capacitor and circuit board built into each bulb, so there will be no messy wires and circuit boards. Each LED requires a minimum of 3 volts to activate with minimum current draw (ideal with your receiver pack). For a meager \$5, you can now scale your aircraft like the real one.

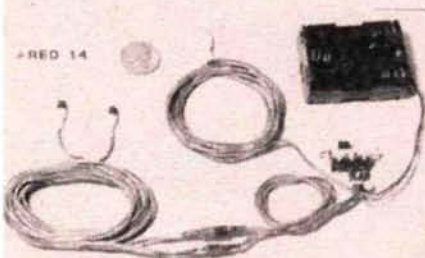


## RAM (RADIO CONTROLLED MODELS INC.)



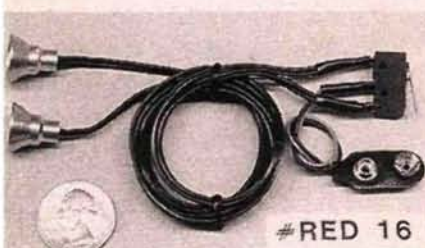
### Flashing Navigation Lights

The new version RAM 01 features extended wing wires to 94 inch span and a Dean's connector for easy wing removal. Retained are the high-quality bulbs and the adjustable flash circuit which allows a wide variety of flash sequences. Operates on 9 volts or a 6-cell Ni-Cd pack, part no. RAM 01  
**Price: \$29.95**



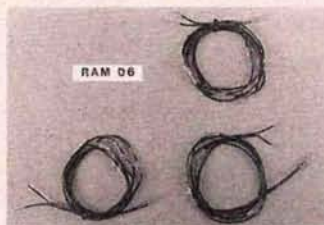
### Big Airplane Navigator Lights

This system contains: three super-bright bulbs with red, green and clear lenses; a 6-foot tail lead; two 7-foot wingtip leads with Dean's connectors; a switch; and a 6-pen-cell battery box. Ni-Cd or alkaline cells are required. The unit weighs 3 ounces, part no. RAM 14  
**Price: \$24.95**



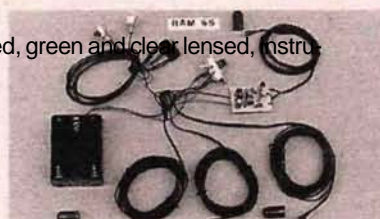
### Econo Landing Lights

This landing light system contains two super-bright bulbs (rated at 2,800 beam-candle-power each) with 5/8-inch-diameter, miluminum, focused reflectors; a microswitch; and a 9V battery snap connector, part no. RAM 16  
**Price: \$19.95**



### Sky Lights

This system is a new concept in lighting a model for special effect or low-light visibility. Its three, 3-foot light strands are mounted in a model that has built-up construction with little or no planking and that is covered with translucent film. A 7.2 to 9V battery will result in a total glowing effect. Part no. RAM 06  
**Price: \$29.95**

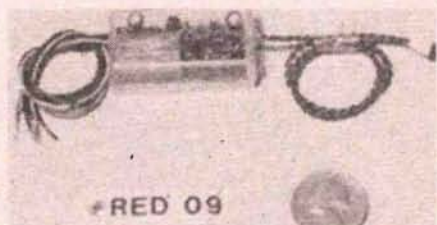


### T6 Large Scale Lighting System

Designed to fit the Midwest T6 kit, this device is adaptable to many models up to 100 inches in wingspan. Three lighting systems are included: non-flashing three-light navigation, Mars adjustable rotating beacon and high-intensity landing lights. Dean's connectors are used to facilitate wing detachment. The system is powered from a 6 pen-cell battery box with a switch. Special lenses and installation details are included. Part no. RAM 65  
**Price: \$59.95**

## FAIL-SAFE DEVICES

## RAM (RADIO CONTROLLED MODELS INC.)



### Battery Backer

This device senses low or intermittent voltage from the primary receiver battery, then it switches to a back-up battery so that the flight can be safely completed. An LED indicates switch-over. A back-up battery and a switch harness are required. Specifications: size—1 3/4 x 1/8 x 1/4 inches; weight—1 ounce. Part no. RAM 09  
**Price: \$39.95**



### Big Model Battery Backer

Designed for the special needs of big models, this redundant battery device drains only one pack at a time and can handle up to 10 amps and 5-cell battery packs. The system includes a box that's 1 1/8 x 3/4 inches, an LED signal light and two high-capacity switch harnesses. The device supplies steady voltage to the receiver and the servos. An integral buss box diverts high-amp battery current from the receiver. The system includes a 6-channel noise trap and buffer drive to reduce RF interference. Part no. RAM 25  
**Price: \$59.95**



### Plane Finder and Transmitter Switch Alarm

The RAM 17 uses the "Black Box" technique: it isn't connected to the radio system; it's totally self-contained and will work with AM, FM and PCM radios. Designed to survive a crash, the homing beeper will sound for up to three days. As a transmitter switch alarm, it will alert you if your switch is accidentally left on. Specifications: size—1 3/4 x 1 x 5/8 inches; weight—1/2 ounce. Part no. RAM 17  
**Price: \$19.95**



### Servo Fail-Safe

In response to requests, this new design features adjustable response delay from 0 to 5 seconds. It is also waterproofable and features a flat design that is half the size of a credit card. Retained from the original RAM 37 is the ability to preset the failsafe position the servo will automatically seek whenever there is a lost transmitter signal or a low receiver battery. Part no. RAM 62  
**Price: \$24.95**



## ELECTRONICS

## MISCELLANEOUS

## ADAPTIVE ENGINEERING

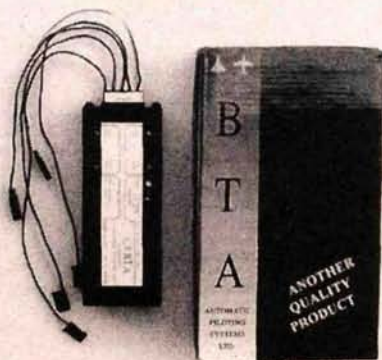
**R/C Talker™**

R/C Talker™ is the world's first speech-based micro-telemetry system for model aircraft. It gives a real-time readout of engine rpm and airspeed in an easy-to-understand female voice. The flight pack (transmitter and sensors) fits into a .40-size aircraft. The 5-channel system can be configured to report any combination of channels, at any reporting rate, and it can also be recalibrated. Typical accuracies within 3 percent. Airborne weight with 2 sensors: 6 ounces. Auxiliary, altitude and vertical acceleration channels also provided. S150s also provides RS232 connection to PC.

Part no. S5150 (without RS232 interface); S5150s (with RS232 interface).

Price: \$399.99; \$449.99.

## CERMARK ELECTRONIC &amp; MODEL SUPPLY

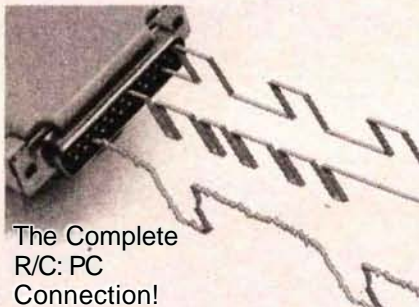
**BTA Auto-Pilot System**

it enables all fliers (beginners, advanced, young, experienced, handicapped, not confident, competition) to fly in all conditions (day, night, windy, gusting, snowing, poor visibility, blind). BTA-006 will also ensure all pilots absolute safety and immunity to radio interference (on PCM), and smooth flight. BTA-006 is the only system with true gyro and a barometric sensor to feel and correct roll and pitch. The stabilizer of the future is here today.

Part no. BTA-006

Price: \$395.95 (with harness)

## COLORADO SPECTRUM, INC.



The Complete  
R/C: PC  
Connection!

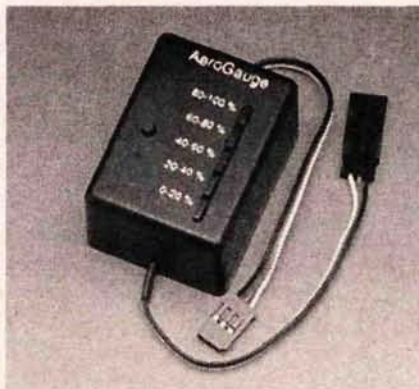
**R/C:PC**

Finally! A comprehensive PC-based tool kit for testing, analyzing and understanding your R/C equipment (even use your transmitter as a joystick with your favorite flight sims!). Software "oscilloscope" lets you monitor and test transmitter (via trainer port), receiver, batteries and servos. Decode and save transmitter mix settings. Check receiver signal accuracy. Test batteries under load. Diagnose servo binding, stalling and gear condition in or out of your aircraft. The complete R/C to PC connection!

Part no. 00501

Price: \$59.95; cable sets \$9.95 each (Futaba, Hitec, JR, Airtronics).

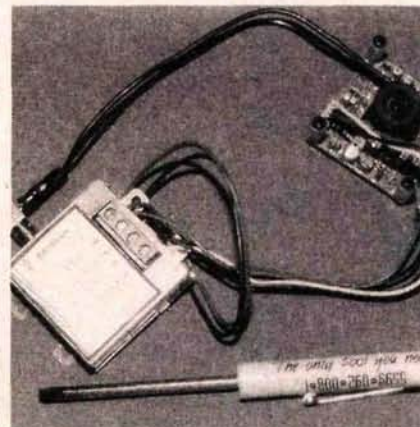
## MEASUREMENT AND CONTROL PRODUCTS

**AeroGauge**

AeroGauge, uses state-of-the-art digital battery monitoring technology to provide measurements of stored battery charge for receiver batteries. It lets you know whether your battery is empty, full, or somewhere in between. It actually measures current flow into and out of the battery. At the push of a button, LEDs display the stored battery charge in increments of 20 percent. It "learns" the battery capacity over time and even compensates for temperature. Flying time can be optimized without worry. 2x1.5 inches; 1 ounce. 30-day money-back guarantee and 90-day warranty. For packs from 500mAh to 2000mAh.

Price: \$49.95 (free shipping)

## RSM, INC.

**Micro 1**

This small, lightweight, wireless, remote video system is perfect for R/C use. The Micro 1 is just over 1 inch square, weighs only 1 ounce and will operate on a 9V battery. The operating range is up to 2,000 feet (line of sight), and the transmitter is coupled with a black-and-white camera. Unlike other remote video products, the Micro 1 comes fully assembled and ready for use, and costs substantially less than other systems.

Part no. Micro 1

Price: \$300 to \$500

## WINDWARD PRODUCTS

**Voltmeter with Full-Function Digital Multimeter**

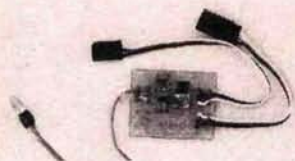
With an added, expanded-scale voltmeter you can determine the condition of your receiver battery pack. This meter will put 37-ohm load on the battery tested, and the display will show the current produced. The WP2000 can also test diodes and measure AC/DC voltage, resistance and DC current to 200mA. The complete package includes meter, probes and an instruction sheet; and it comes with a 1-year warranty.

Part no. WND2000

Price: \$29.95



ZZ ENTERPRISES INC.



### Go Light On-Board Battery-voltage Monitor

This unit is foam-wrapped and can be plugged into your receiver, or between your receiver and any servo, to continuously monitor receiver battery voltage. Operate servos; if LED glows green it's OK to fly (greater than 1.8 volts); if LED glows red, it's time to recharge. Identifies binding controls, servo against stop, loose connections and weak battery before you fly. Order by mail or by phone any day or evening. Specifications: threshold—4.8 to 4.76 volts; current—15mA. Part no. 951 (with one connector); 952 (with two connectors).  
Price: \$19; \$21.

## FUEL & ACCESSORIES

FUEL

BYRON ORIGINALS



### Performance Blended Fuels

Byron fuel is available with nitromethane percentages of from 0 to 60 and with either a straight synthetic lubricant or a special synthetic/castor-oil blend (special 45- and 60-percent-nitro blends are favorites). To guarantee maximum protection and optimum engine performance, the fuel is blended in computer-controlled facilities, and only the purest methanol, nitromethane and proprietary lubricants are used.  
Part no. various  
Price: various

POWERMASTER  
PRODUCTS, INC.

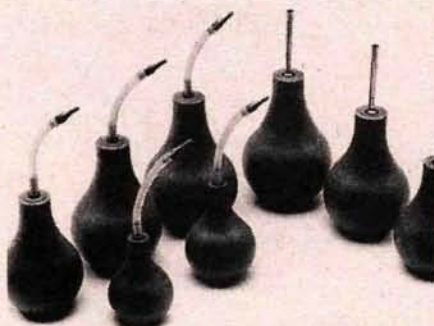


### Golden Break-In Fuel

This exclusive new fuel was specifically formulated for breaking in new engines to attain the life and performance built in by the manufacturer. Professionally tested over many years by well-known hobby writer Stu Richmond, Golden Break-In Fuel may be used for all types of engines: 2-stroke, 4-stroke, ABC, ringed, iron piston, etc. Includes a 24-page instruction booklet that outlines techniques proven by Richmond during 50 years of engine testing. A full line of other fuels is also available.  
Price: \$12.45/half-gallon

FUEL PUMPS

AEROTREND PRODUCTS



### Squeezme Fuel Bulbs

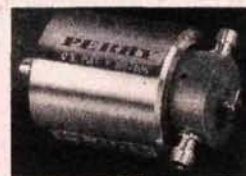
"Squeezme" fuel bulbs are guaranteed for life. These fuel bulbs are specially formulated to eliminate internal flaking and deterioration. All-brass fittings are included, and the regular version includes a piece of "Blue Line" silicone tubing and a nylon nozzle. They're available in 2-, 4-, 6-, 8- and 10-ounce sizes. (Fast-fill versions for the 6-, 8- and 10-ounce sizes are also available for \$1 more.) New: a 7/32 slotted ball tip, fast-fill version is also available.  
Part no. 1101 (2 ounce); 1103 (4 ounce); 1105 (6 ounce); 1107 (8 ounce); 1109 (10 ounce).  
Price: \$6.99 to \$10.99

VARSANE PRODUCTS



### VP-20 Oscillating Pump

The VP-20 oscillating pump is for 4-stroke engines; it's not recommended for smooth-idling 4-stroke twins. Specifications: dimensions—2x3/4x1 inches; weight—25 grams (less than 1 ounce); suitable for alcohol-based fuels. Also available is the VP-22 pump, which is basically the same, but its internal parts and materials are compatible with gas- and petroleum-based smoke fuels. To use the VP-22 pump for smoke operation, install a one-way check valve.  
Part no. VP-20; VP-22.  
Price: \$29.95; \$34.95.

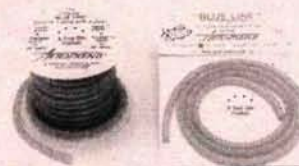


### VP-30 Regulating Pump

This pump has a built-in regulator that will supply fuel with constant pressure, regardless of the fuel's level or position of the tank. Specifications: width—1 inch; length—1.5 inches; weight—23 grams (less than 1 ounce); fuel—alcohol based. Also available is the VP-40SG pump (not shown), which is similar to the VP-30, but it's for gas engines, and it can be used as a smoke pump using diesel fuel, etc.  
Part no. VP-30; VP-40.  
Price: \$32.95

### TUBING, VALVES AND FILTERS

AEROTREND PRODUCTS



### Blue Line Fuel Tubing

Aerotrend's Blue Line silicone fuel tubing is thick, strong, highly heat-resistant and flexible. It stays on fittings better, has terrific bend and eliminates problems with cracking and melting. Available in: 3 feet per package, 30-foot reels and 50-foot reels.  
Part no. 1001 (3/4-inch i.d., 3 feet); 1003 3/32-inch i.d., 3 feet); 1005 (1/8-inch i.d., 3 feet); 1007 (5/32-inch i.d., 3 feet); 1011 and 1013 (50-foot reels); 1015 and 1017 (30-foot reels); 1019 (5/32-inch i.d. x 11/32-inch o.d. on 50-foot reels).  
Price: \$1.99 to \$2.69 (nos. 1001-1007); \$32 (nos. 1011 and 1013); \$19.99 to 21.99 (nos. 1015 and 1017); \$47.99 (no. 1019).



# FUEL & ACCESSORIES

## AEROTREND PRODUCTS



### Easy Flex Gas/Diesel Fuel Tubing

Easy Flex gas/diesel fuel tubing is the alternative to neoprene for gas and diesel fuel line. It's for 1/4-scale engines (Quadra-type). It's highly heat-resistant, yet stays pliable at very low temperatures. It's translucent and flexible, yet maintains a thick wall for strength. Available: 1/8-inch i.d. or the new size: 1/4-inch i.d. The new and larger size is great for smoker systems.

Part no. 1073 (1/8-inch i.d., 2 feet); 1077 (1/8-inch i.d., 30 feet); 1074 (1/4-inch i.d., 1 foot) or 1078 (1/4-inch i.d., 50 feet).

Price: \$2.59; \$32.99; \$2.39; \$78.99.

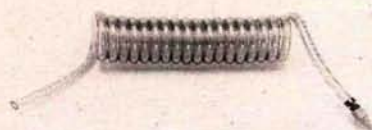


### Fire Line Silicone Fuel Tubing

Aerotrend, the tubing people, have added to their fuel tubing line new "Fire Line" for the modeler who wants to match his tubing to his model. "Fire Line" is the hottest new tubing in town. Made of high-quality silicone tubing, which is highly heat resistant, thick, strong and very flexible. A full 3 feet per package—3/32-inch i.d. x 7/32-inch o.d.—it comes in five hot colors: red, yellow, pink, green and orange. Match Aerotrend's colors to your models.

Part no. 1093/R (or color choice first letter); 1091 (combo package; one of each color).

Price: \$2.99; \$13.99.

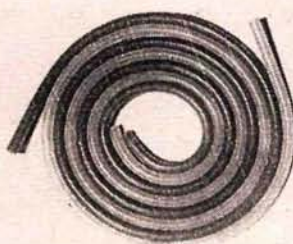


### The Coiler

The "Coiler" is a new filler setup for those modelers tired of stepping on their filler hoses. It's a 6-foot-long coil of heavy-duty, fuel-proof tubing and an end-of-the-line nozzle. Specially made for filling the tanks on all glow-fuel and gas/diesel engines, the Coiler uncurls for easy filling and then curls back for storage. A must for the avid hobbyist.

Part no. 1089

Price: \$6.29



### Vent-A-Line

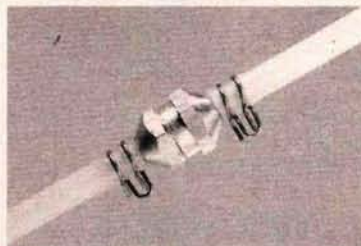
Aerotrend's new Vent-A-Line setup consists of 6 feet of two different colors of their silicone tubing. The purpose of the Vent-A-Line kit is to eliminate confusing your tank line with your vent line. It may also be used where line identification is mandatory. The setup comes in two sizes: 3/32-inch i.d. (standard size) and Vs-inch i.d. (large size).

Part no. 1003/V (standard); 1005/V (large).

Price: \$4.59

## MISCELLANEOUS

### DU-BRO PRODUCTS



### Fuel-Line Clips and Combo Packs

Du-Bro's new fuel-line clips help prevent fuel tubing from coming off fuel fittings. Available in two sizes to fit Du-Bro's medium (3/32-inch i.d., 2.3mm) and large (Vs-inch i.d., 3mm) fuel tubing. These fuel-line clips are zinc-plated and are packed four to a package.

Part no. 677 (medium); 678 (large)

Price: \$1.25



### Giant Size Fuel Tanks

Big airplanes are the fastest-growing segment in the model airplane industry. Many modelers, from all over the world, have called us and asked for bigger fuel tanks. Our new 32-ounce (950cc), 40-ounce (1200cc) and 50-ounce (1500cc) fuel tanks come with fuel stoppers; tubing for both glow fuel and gasoline; and a nickel-plated, large-size clunk.

Part no. 690 (32 ounces); 691 (40 ounces); 692 (50 ounces).

Price: \$7.50; \$9.50; \$11.50.

## K&S ENGINEERING



### Fueling Accessories

The Sta-Flex Fuel Line comes in small, medium and large diameters on 25- and 50-foot rolls. It is translucent, highly flexible and non-hardening. Once your runs are over for the day, the premium-quality Pro-Lube Oil makes the perfect after-run oil. It neutralizes acids due to glow-fuel combustion and protects all metal parts against corrosion. Great for long-term storage, too.

Part no. 410 (small fuel line); 411 (medium fuel line); 412 (large fuel line); 700 (Pro-Lube Oil).

Price: \$3.50 to \$10

## METALON PRODUCTS



### Metalon C2

Metalon C2, 10 years later, remains the choice of champions. Engines of all sizes fueled with gasoline, diesel, glow, or "home brews" reap the benefits: increased power, greater reliability, wear reduction, longer life, no break in, no castor and fewer maintenance and storage problems. Beware: "Johnny-come-lately" products try to mimic Metalon C2. Fly with the confidence of champion pilots at Madera Air Races, Top Gun, etc. Improve the performance of your engines (helis, jets, boats, cars, vintage, sport, competition) with Metalon C2.

Price: \$12.75/8-ounce bottle.



# FIELD/PIT ACCESSORIES

## POWER PANELS

### CERMARK ELECTRONIC & MODEL SUPPLY



#### Deluxe Power Panel and Super Panel

The Deluxe Power Panel has a solid-state, IC design for your classical 12V operation; 12 volts, 6 volts and adjustable 1.5V output; complete with accessories. The Super Panel is a one-of-a-kind automatic power panel with built-in ESV, featuring: auto glow-plug driver, integrated ESV for transmitters and receivers, Ni-Cd glow-plug battery charger, 12V engine starter power outlet, 12V/6V fuel-pump connection with control switch, main power switch with LED, low battery warning and reverse polarity protection.

**Price: \$19.95 (Deluxe Power Panel); \$34.95 (Super Panel).**

## HOBIBICO



#### Accu-Glo Power Panel

The Hobbico Accu-Glo Power Panel takes care of the usual power-panel duties, operating all electronic field gear from a single 12V battery, while also using advanced but affordable electronics to continually monitor glow-plug heat. Accu-Glo provides constant, automatic glow-plug power management, automatically. Accu-Glo also includes a spring-loaded, three-position fuel-pump switch that prevents accidental overfilling by locking only in "empty." A green LED shows that the field battery is sufficiently charged, or it changes to red when it's time to recharge.

Part no. HCAP0305  
**Price: \$49.99**

## FIELD BOXES

### BYRON ORIGINALS



#### Pit Pal

This ready-to-use field box is made of injection-molded high-impact polyethylene. It has space for tools, a 12V battery, a transmitter, a starter, 1 gallon of fuel and a power panel. Handle stanchions accommodate your choice of electric or manual fuel pumps. (The accessories shown aren't included.)

Part no. 6130220

**Price: \$24.95**

### CERMARK ELECTRONIC & MODEL SUPPLY



#### FB-1002

#### Prebuilt Field Box

Completely built, painted and fuel-proofed right out of the box! This sturdy wooden flight companion features a pre-cut power panel section, two drawers, adjustable cradle and a removable starter box. The field box is available in red, blue, or yellow.

Part no. FB-1002

**Price: \$48.95**

## STARTERS

### ROYAL PRODUCTS CORP.



#### Heavy-Duty Starter

This heavy-duty starter has power to spare. It features a coiled cord, a tapered silicone drive cone and pre-installed battery clips.

Part no. 78-461

**Price: \$43.95**

## MISCELLANEOUS

### BYRON ORIGINALS



#### Craft Cuddler

This portable workbench will support boats, aircraft and cars. It requires no painting and minimal assembly. Strong straps are fitted with Velcro® fasteners to hold the craft in place during repairs or adjustments. The Craft Cuddler's height, width and length are fully adjustable to accommodate any model weighing up to 40 pounds.

Part no. 6130230

**Price: \$29.95**

### DU-BRO PRODUCTS



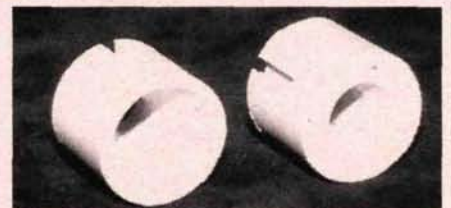
#### Transmitter Tray

For precision control of any model, take a look at Du-Bro's new transmitter tray. This transmitter tray is ergonomically designed with full adjustment of the aluminum shoulder straps and palm rest. The transmitter tray allows for fingertip handling to achieve precision control of the model. Constructed of polished anodized-aluminum stock and UV-stabilized plastic, this transmitter tray will securely hold any transmitter.

Part no. 620

**Price: \$89.95**

### MILLER R/C PRODUCTS



#### Airplane Starting Inserts

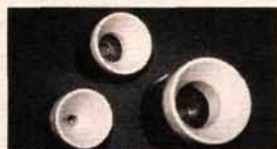
Miller inserts will not mar or damage your cones. Sky Grip is configured for airplanes with nose cones. Tuff Grip is designed for airplanes with nut and washer, Quad's, 1/2 A free flight and rear start chopper.

Part no. SG201 (Sky Grip); TG301 (Tuff Grip) for Sullivan Starters. RSG201; RT301 for Taiwan and Japanese starters.

**Price: \$7.49; \$7.99.**



## MILLER R/C PRODUCTS



### Big Grip Starting Cup-Insert

Designing your own starter system? Miller R/C Products has the solution. Big Grip Starting Cup-Insert is engineered to fit large nose cones. They are available in three sizes (3, 3½ and 4 inches). Black-anodized aluminum with a high-tech rubber insert. Big Grips can be machined for your starter or blank so you can machine for your correct application.

Part no. 3, 3½ and 4 inches

Price: \$46.95 to \$132.95



### Persuader Belt Reduction Assembly

The Belt Reduction is designed to start those big cubic-inch engines. Plenty of torque for engines that are hard to start. It has a 4:1 ratio to give you four times more torque and operates at 1,400 to 1,800rpm. Easy to mount on your starter. No. BGSB replacement insert for 3V2- to 6-inch nose cones; no. BGTG reversible replacement insert. New BGSB-2 is for 2V2- to 3½-inch nose cones. \$97.00 per unit, \$157.00 unit mounted on dynatron.

Part no. BGSB (3½- to 6-inch nose cones); BGSB-2 (2V2- to 3½-inch nose cones); BGTG (replacement insert).

Price: \$97; \$157.

## MODEL PRODUCTS CORP.

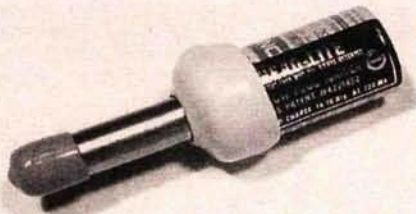


### Half-A-Lock Glow-Head Connector

At last, a positive connector for 1/2A glow heads, and it fits all Cox and Glo-Bee glow heads (except .020 and .010) with 24-inch lead wires. No. 050 is supplied with ring terminals for connecting to dry/wet cells. No. 051 has an adapter that's compatible with all Head-Lock and Head-Lite glow-plug connectors and igniters.

Part no. 050; 051.

Price: \$8.95; \$9.95.



### Head-Lite II Glow-Plug Igniter

Head-Lite II features a field replaceable 1.3Ah Sanyo battery (will accept all sub-C diameter cells including Sanyo's 2.0Ah unit); a patented stainless-steel "Head Lock" connector; all stainless-steel welded construction; and is fully guaranteed against all material and manufacturing defects. True locking is accomplished with a simple push twist (no force) motion. The igniter comes with a vinyl body cover and safety cap/dust cover.

Part no. 045 (no battery or charger); 040 (with battery, no charger); 041 (with battery and charger).

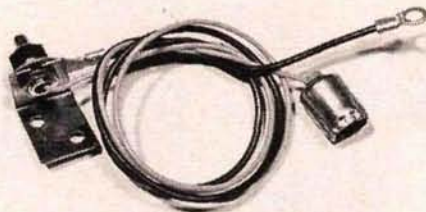
Price: \$9.95; \$15.95; \$25.95.



### Head-Lock Connectors

Head-Lock Connectors are the only patented, positive locking units on the market. A simple, two-finger "push-twist," no-force motion will connect and disconnect them, making them safe and easy to use. The Mark III has a brass body and 30-inch lead, and the Professional has a stainless-steel body and 48-inch lead. Head-Lock connectors fit all standard 2- and 4-stroke glow plugs, and they're fully guaranteed.

Price: \$5.95 (Mark III); \$8.95 (Professional).



### Head-Lock Remote Single Glow-Plug Connector

The Head-Lock Remote Single is designed for safety for cowl engines. It fits all standard 2- and 4-stroke plugs, including those from K&B and Enya. A stainless-steel mounting bracket is supplied for the jack, which is compatible with all Head-Lock connectors.

Part no. 021; 022.

Price: \$9.95; \$13.95.

## ROYAL PRODUCTS CORP.



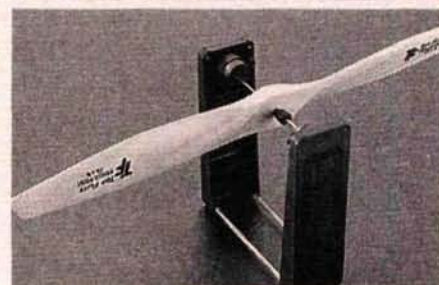
### Field Support Package

This package from Royal includes matched field accessories at a great price. The set includes a field-box kit, a heavy-duty starter, a 12V electric fuel pump, a 12V sealed battery, a 12V charger, a power panel and a locking glow-plug clip.

Part no. 80-038

Price: \$161.95

## TOP FLITE



### Precision Magnetic Balancer

Accurately balance props (up to 24 inches), spinners, ducted-fan rotors, etc., with this magnetic balancer. The trued, steel, balancing shaft is suspended between two powerful magnets (one end actually floats), and that minimizes friction interference. Use it anywhere to reduce vibration.

Part no. TOPQ5700

Price: \$29.99



# BUILDING MATERIALS

## WOOD

### RITECO SUPPLY INC.



#### Hoop Pine Plywood

Produced in Australia since 1917 from plantation-grown trees, this premium-grade plywood is free of open-hole knots and compressed areas. Uniquely flexible, its grain is tight and its color is uniform (much whiter than parana pine), so it's great for hobby work. Never before marketed in the USA, this unique lightweight plywood is made from 100-percent plantation hoop pine and is available in interior and exterior grades. Part no. Widths of 1.5mm (1/16 inch) to 12mm (1/2 inch).

Price: Depends on width.

## ADHESIVES

### AEROSPACE COMPOSITE PRODUCTS



#### EZ-LAM

EZ-LAM epoxy laminating resin is now available in 12-ounce packages. This new size is ideal for trying out laminating and fiberglassing techniques without investing in a lot of resin. It's available in either 30- or 60-minute "pot-life" versions. (The 60-minute epoxies are also available in 1 1/2-gallon, 1 1/2-quart and 1 1/2-pint kits.)

Part no. E30-01; E60-01.

Price: \$13.50 (12 ounces); \$92 (1 1/2 gallons); \$38 (1 1/2 quarts); \$24 (1 1/2 pints).

### BOB SMITH INDUSTRIES



#### Maxi-Cure

This extra-thick CA bonds most types of plastic (including polycarbonates), hardwood, metal and rubber in 10 to 25 seconds. Complements Bob Smith Industries' Insta-Cure and Super-Gold CAs.

Price: \$3.29 to \$29.99



#### New Insta-Set and Un-Cure

Bob Smith Industries' new formula for Insta-Set is freon-free and totally compatible with all plastics and white foam. Strawberry scented Insta-Set cures CAs to a clear, non-brittle solid. Also available are Un-Cure, extender tips, applicators and replacement tops.

Part no.  
Price: \$4.99 (2-ounce Insta-Set); \$10.99 (8-ounce Insta-Set refill); \$2.99 (1-ounce Un-Cure).

### GREAT PLANES MFG.



#### Pro CA Glue and Epoxy

Great Planes Pro CA adhesives are the first and only to offer a satisfaction guarantee, with a "best if used by..." date printed on each bottle. Consistent in quality from one bottle to the next, Pro CAs feature a clean, pure formula that's absolutely free of all impurities, providing maximum bond strength. Great Planes Pro CAs are available in 1/2-ounce, 1-ounce, 2-ounce and 4-ounce sizes. Pro Epoxy is available in 6-, 30- and 45-Minute.

Part no. GPMR6001-GPMR6048

Price: \$3.49 to \$19.95

### JEFFCO PRODUCTS



#### 2105/5105 Epoxy System

This easy-to-use, 5-minute, 1:1 epoxy system is very safe and has no objectionable odors or fumes. It cures fully in as little as 15 minutes, and it forms fast, strong, resilient bonds with high-impact strength. The 2105/5105 Epoxy System is ideal for quick field repairs and dependable shop construction.

Part no. 2105/5105

Price: \$9.95/2 4oz. bottles

### NORTHWEST TOOL SUPPLY



#### CAs and Epoxies

Northwest Tool Supply wants to be your one-stop source for adhesives. They carry the full line of Bob Smith Industries CAs and epoxies and West System Epoxies. They guarantee these adhesives to be the fastest in the industry! They offer a full 2-year guarantee on all their adhesives. If you want the freshest adhesives, at good prices, let Northwest Tool Supply fill your needs. Call them today. (Visa/MasterCard accepted.)

Part no. various

Price: various

## COMPOSITES

### AEROSPACE COMPOSITE PRODUCTS



#### EZ-VAC Kit

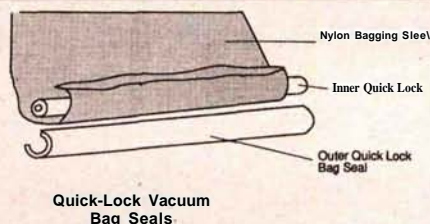
The EZ-VAC Bagging System contains everything you need to make professional-quality vacu-bagged parts, including an electric pump, a bagging tube, breather felt, Quick-Lock bag seals, a vacuum connector/valve and hoses.

Part no. V-02

Price: \$85



## AEROSPACE COMPOSITE PRODUCTS



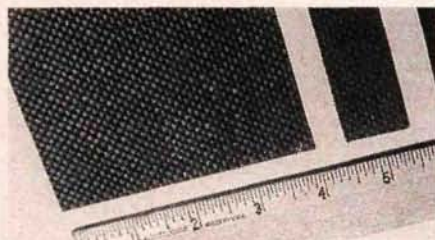
Quick-Lock Vacuum Bag Seals

## Quick-Lock Bag Seals

Aerospace Composite Products now offers the ultimate in vacu-bagging technology—Quick-Lock bag seals. These two-piece, 24-inch-long, extruded-nylon seals can be quickly snapped into place across the open ends of 18-inch vacuum bags. Quick-Locks are reusable, and because you'll no longer have to cut sticky sealing tape off your vacuum bags, your bags will be reusable, too.

Part no. V-12C

Price: \$3 each



## Woven

## Carbon-Fiber Laminates

These new .014-inch-thick, 48-inch-long, carbon-fiber laminates have a bi-directional weave and are available in 1/2-, 1-, 2- and 4-inch widths. They're perfect for strengthening and stiffening components.

Part no. CLW-1-42; CLW-1-43; CLW-1-44; CLW-1-45.

Price: \$6.50; \$6; \$11; \$21.

## MISCELLANEOUS

## AEROSPACE COMPOSITE PRODUCTS



## E-Z Clean

E-Z Clean all-purpose cleaner safely removes adhesives, glues, resins and other materials, and it comes in 12-ounce bottles.

Part no. T-09

Price: \$5

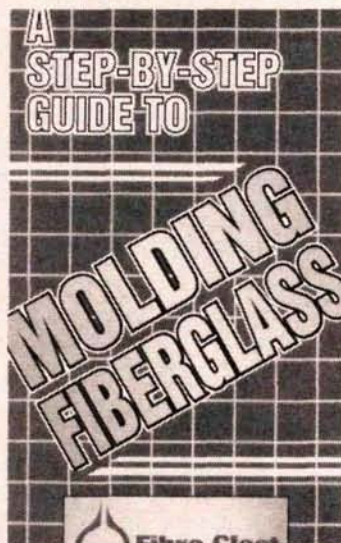
## DAN PARSONS PRODUCTS



## Fiberglass Cloth

No, his deHavilland Hornet twin isn't for sale; just the identical 0.6-ounce fiberglass cloth that has covered it for 12 years. Strong, light and permanent, Dan Parson's Products has supplied this first quality and lightest of woven glass cloth for 16 years to modelers in all 50 states and 42 countries. Dan Parson's Products special-orders its cloth to factory specifications for model use. Complete covering instructions are included. 38 inches wide; 15- and 30-foot packages.

## FIBRE GLAST DEVELOPMENTS CORP.



## "A Step By Step Guide to Molding Fiberglass" Video

This video is a complete demonstration of the seven steps of molding fiberglass. "A Step By Step Guide to Molding Fiberglass" covers how to prepare a part to be duplicated, how to make a mold and how to make parts from the mold. Each video is shipped with a free product catalogue and a materials list outlining each step as shown in the video and the products used.

Part no. 781-A

Price: \$34.95



## Fiberglass Materials

Fibre Glast Developments is an excellent source for everything you need to build/repair your models, including: fiberglass fabrics, carbon fabrics and veils, aramid fabrics and veils, polyester resins, gelcoats, room-temperature and high-temperature epoxy resins, vacuum-bagging materials, balsa, polyurethane foam, honeycomb, mold releases, tools and supplies. The complete product catalogue is free of charge.

Part no. various

Price: various

## GREAT PLANES MFG.



## Model Parts and Accessories

Every part and accessory you need is available in Great Planes' line of high-quality parts and accessories. In this complete line of model hardware and accessories, even the most ordinary item is loaded with problem-solving innovations. Convenient, money-saving bulk packages of many frequently-used items, such as clevises, are available. Most Great Planes hardware and accessories come packaged in reusable Parts Pak™ containers, and all are backed with a one-year quality guarantee.

Part no. various

Price: various

## K&amp;S ENGINEERING



## Tubing and Shapes

K&S offers the widest selection of metals for hobby, craft and modeling use. Featured are brass round, square and rectangular tubing, angle, channel, strip and rod. Also available is aluminum tubing, streamline and sheet, and brass and tin sheet. All tubing and shapes are 12 inches long, and the rectangular sheet metal is 4x10-inch pieces.

Part no. various

Price: various



# AIRPLANE ACCESSORIES

## RETRACTS

### BODDEN MODEL PRODUCTS

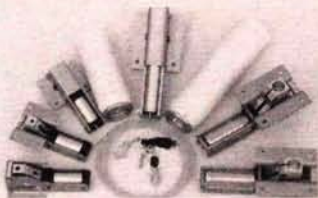


### Gear/Door Sequencer

The Gear/Door Sequencer is a new, high-tech, all-electronic device developed by BMP that enables sequencing of two servos with a single input channel. One servo connects to the gear and one to the doors. The speed of each can be adjusted from .4 to 12 seconds. Several models are available: mechanical (BP-321); pneumatic (BP-331); limit switch (BP-341); and asynchronous (BP-351) for the serious scale modeler. The device measures 1 x .65. Prices start at \$49.95.

Part no. BP-321  
Price: \$49.95

### SPRING AIR PRODUCTS



### Pneumatic Retract Systems

Available to suit 5/32- or 3/16-inch legs, as well as Oleo struts, Spring Air Products' pneumatic retract systems are simple, durable and easy to install. Features include patented, one-piece frames made from aircraft-grade T-6 aluminum; a fail-safe spring; positive mechanical locks; and a new toggle-valve that allows microservo actuation. Available with retract angles of 90, 80, or 74 degrees and in three styles of steerable nose gear. Models available to support aircraft of up to 30 pounds (standard size supports up to 14 pounds).

Price: call

## THE LIKES LINE



### The Likes Line Retracts

These retracts are an electrical jack screw operation that provides standard and rotation strut movement. Retracts come with struts, battery pack, charger and switch harness. Struts are interchangeable, providing use for more than one aircraft. Retracts have adjustable strut speed and angle. Fixed landing gear feature a strut adapter for wing or nose mounting, making installation a snap. Struts are spring Oleo, scale in appearance and cut for your requirements. Forks are cast of ALMAG-35.

Part no. Retracts available for 90 to 120, 1/5-, 1/4- and 1/3-size aircraft; strut diameters are 1/2-, 3/8-, 1/4- and 1/8-inch. Forks range in tire size from 2 1/2 inches to 6 1/2 inches.

Price: Send SASE for additional information.

## MISCELLANEOUS

### AEROTREND PRODUCTS



### Rainbow Bands

From Aerotrend—Rainbow Rubber Bands! A rainbow of no. 64 premium rubber bands to match your many different colored aircraft. Aerotrend now offers now offer Rainbow Bands in seven different colors. They keep your wing firmly attached to your fuselage and look great to boot. Offered in packages of all one color, or a package of all colors. Colors are white, blue, yellow, green, red, black and orange.

Part no. 1180 (all one color; specify color choice); 1185 (all colors).

Price: \$3.29

## BOB DIVELY MODELS



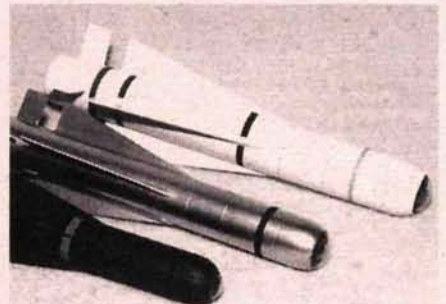
### Scale Accessories

Scale accessories from Bob Dively Models include complete interior kits for 25 popular scale models. They also offer drop tanks, bombs, exterior details, retract wheel wells and dummy radial engines. Wheel pants are also available in four sizes. Order directly from Bob Dively Models, or send \$3 for a catalogue and a complete list.

Part no. various

Price: various

## EAGLE MINIATURES INC.



### AGM-65

### Maverick Missiles Kit

This pre-scored, vacu-formed kit can be built into a pair of Maverick missiles, including the clear sensor lens and clear dome assembly. The full-scale version of this kit was used in Desert Storm. Stripes are included. Requires assembly and painting.

Send \$2 and a SASE for a weapon accessory catalogue.

Part no. 1-838-2 (1/8-scale); 1-839-2 (1/9-scale); 1-830-2 (1/10-scale).

Price: \$22 (two missiles per kit).



## PAINTING/FINISHING SUPPLIES

# PAINTING/ FINISHING SUPPLIES

## COVERINGS

### BOB DiVELLY MODELS



#### Liquid Masking Film

Bob Dively liquid masking film has been called "the answer to a modeler's prayer" because it works. Liquid masking film can be used on all non-porous surfaces, and it leaves razor-sharp edges over curved surfaces, where masking tape bleeds. Order direct from Bob Dively Models, or see your Great Planes Distributor.

Price: \$4.95 plus \$1.50 (4 ounces); \$12.10 plus \$2.25 (16 ounces); 19.25 plus \$3 (32 ounces).

### COVERITE



#### 21st Century Fabric

21st Century Fabric is a revolutionary advancement in fabrics, as only this material can offer modelers a pre-painted fabric iron-on with a finish as magnificent as hand-rubbed lacquer. No primer. No paint. No protective coating needed. Simply iron on 21st Century Fabric and achieve a realistic scale appearance without the additional finishing steps required of all other fabrics. Amazingly thin and lightweight—yet the strength of this fabric cannot be matched by any film.

Part no. 8300 to 8414

Price: \$23.95 (27x72 inches); \$59.88 (27 inch-esx15feet).



#### 21st Century Film

A "Space Age" film covering made out of an advanced polyester with the unique advantage of Shrink Control (Sm). Conventional films shrink rapidly and uncontrolled, while 21st Century Film shrinks slower, providing greater stability and higher resistance to changing weather conditions for longer lasting finishes. When properly applied, 21st Century Film will maintain its original finish—bubble, wrinkle and sag free—even when exposed to wide ranges of temperature and humidity variations.

Part no. 8200 to 8217

Price: \$14.95 to \$17.95



#### Balsarite

A crystal-clear liquid adhesive that's brushed on to wooden planes prior to covering with heat-shrink materials. Its deep penetration seals, moisture-proofs, strengthens and makes all iron-on coverings stick better. It also reduces sagging, fuel creep and bubbling. And now, Balsarite is available in film or fabric formula.

Part no. 6000-6003.

Price: \$4.95 (half-pints); \$8.75 (pints).



#### Black Baron Film and Presto

An economical, low-heat polypropylene film, Black Baron's soft, pliable characteristics make it easier to contour around even the most complex surface curves. Its low heat range makes it ideal for solid-surface applications, including application over some foams. Black Baron Presto is the same high-quality film as Black Baron film, but it has a pressure-sensitive adhesive coating instead of the standard heat-activated iron-on adhesive, which makes trim applications trouble-free.

Part no. 9111 to 9426

Price: \$12.99 to \$34.98 (film); \$1.75 to \$8.50 (Presto).



#### Ironex

Helps prevent and remove adhesive building on covering irons. Works as a thinner for Balsarite. Also cleans oil and grease from engines. Available in 1/2-pint cans.

Part no. 3200

Price: \$4.50 (1/2-pint)

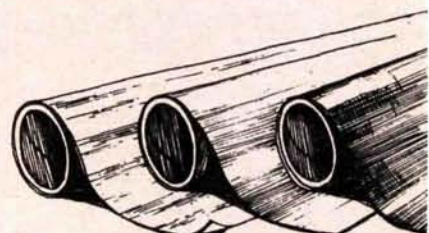


#### Micafilm

An iron-on film reinforced with extremely tough yet exceptionally tough mica fibers, making it more than seven times stronger than any other covering. Micafilm has no adhesive coating; it's applied by brushing Balsarite on the wood surfaces. This weight saving makes Micafilm one-half the weight of conventional iron-on films. Colors: pearly white, red, blue, metallic blue, orange, yellow, green and aluminum. Also available in pre-primed form, ready for painting. Sizes: 29x65 inches and 29x15 inches. Weight: 1.3oz./sq. yd. (Clear is only 3/4oz./sq. yd.)

Part no. 2501 to 2612

Price: \$9.95 to \$12.95 (small rolls); \$27.55 to \$35.86 (large rolls).



#### Super Coverite

The original iron-on fabric, which can be finished with a coat of clear, or painted to simulate the fabric-covered aircraft of the pre WW II era. Super Coverite's unique so adhesive system allows for easy molding around corners. The incredible strength of this woven material has set the industry standard for more than 25 years. Color: white, red, yellow, blue, orange, antique tan, Supershink White and olive drab.

Part no. 1101 to 1258

Price: \$10.95 (38x45 inches); \$49.95 (45x1 feet).



## TOP FLITE



## MonoKote

lonoKote covering, available in opaque, pearl, metallic, neon and transparent colors; a favorite covering of modelers worldwide. lonoKote is easy to use—stretching easily over wingtips, turtle decks and other difficult surfaces—and every roll has the same beautiful, high-gloss luster. Available in 6- and 25-foot rolls, MonoKote always provides a professional, fuelproof finish. Part no. TOPQ0200 to TOPQ1510  
**Price: \$15.99 to \$105.99**

## PAINT AND ACCESSORIES

## CHEVERON HOBBY PRODUCTS



## Perfect Paint

perfect Paint features an actual paint chip on each can's label to aid in color selection. New Ultracote and Monokote are computer color matched to Ultracote and Monokote wing covering. More than 30 camouflage colors fire computer color matched to the federal standards for authentic color reproductions of military aircraft. These colors use non-toxic pigment and feature excellent flow and adhesion. Fillers, primers, display racks, engine cleaners and thinners are also available.  
**price: \$9.98 (8 oz.); \$11.98 (11 oz.).**

## COVERITE



## 21st Century Paint

21st Century Paint's advanced formulation provides modelers with a fast-drying, easy-to-apply finish, designed to withstand the punishment of R/C flying. Dries dust-free in 15 minutes. Additional coats can be sprayed every 3 minutes. Within 12 hours, fuelproof up to 15-percent nitro, and can be masked, striped or decaled. Highly resistant to chips, tracks and scratches. Unique high-tech nozzle sprays an airbrush-style fan pattern. Available in 23 colors plus a sandable white primer.  
 part no. 8100 to 8124  
**price: \$8.95 (13-ounce net weight)**



## Black Baron Paint

This paint features all the advantages of two-part epoxies without the fuss and short pot life. It's fuelproof, light and super-tough, and you get a terrific high-gloss shine. It's very flexible and can be used on fabric, wood, metal and many plastics. Colors: white, fire red, lemon yellow, int'l. orange, black, cub yellow, brite red, dk. blue, lt. blue, lt. gray primer, gloss clear, flat clear.  
 Part no. 9000 to 9099  
**Price: \$5.95 (13 oz. net wt.)**



## Glaskote

A clear liquid polyurethane that can be brushed or sprayed over any painted surface to produce a tough, light outer skin. The high-gloss formula is 94 percent clear, and fuelproof. Available in 1/2-pint cans.  
 Part no. 4500  
**Price: \$5.95**



## Primex

This premium nitrate dope for fabric coverings provides great adhesion and prevents masking tape from ruining your paint job when you remove it. It's ultralight, smooth and quick drying, and it's easy to apply and sand. Primex is great on wood, tissue, silk, Dacron and Super Coverite, and it's compatible with any paint. Primer and thinner available in 1/2-pint cans.  
 Part no. 3100 (primer); 3101 (thinner).  
**Price: \$5.50 (1/2-pint primer); \$4.75 (1/2-pint thinner).**

## PAINTING/FINISHING SUPPLIES

## PACTRA COATINGS



## Formula-U Spray Paint

New low pricing! Resistant to a 30-percent nitro-methane content, Pactra Formula-U offers modelers the ultimate fuelproof and waterproof finish for your models. Formula-U 12-ounce spray is an easy-to-use, one-step, high-hiding polyurethane system that features a tough, mar-resistant finish in fewer coats. Formula-U gives you durability, flexibility and resilience in rich, super-high-gloss colors, including colors to match popular film covering. Also available in 3 1/2-ounce bottles. Part no. 20100 Series  
**Price: \$3.98 (12 oz. spray can)**

## TRIM

## COVERITE



## American Aircraft Decals

This series of 11 fuelproof vinyl decals was inspired by the cartoon drawings that appeared on the noses of WW II bombers. Each decal is silk-screened in up to six vivid colors. They look great on the noses, wings and tails of any model, from any era, and they'll stick to any surface, including field boxes. The decals are available in two sizes: 4-inch (11 designs) and 2 1/2-inch pairs of left and right images (5 designs).  
 Part no. 2301 to 2365  
**Price: \$2.50 (4-inch); \$2.95 (2 1/2-inch).**



## Graphics

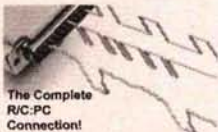
Coverite offers razor-sharp, pressure-sensitive, die-cut vinyl letters, numbers, stars, stripes and trim sheets that will stick to any surface and conform to any curve. These fuelproof, paintable graphics can be repositioned during the first hour. Numbers are available in sizes from 1/4 inch to 3 inches; letters from 1/4 to 2 inches; stars from 1/2 to 3 inches; and stripes in 1/16-, 1/8- and 1/4-inch sizes (all on one sheet). All graphics are offered in red, white, blue, yellow and black.  
 Part no. 7000 to 7514  
**Price: \$2.95 to \$6.95**



## MISCELLANEOUS

## MISCELLANEOUS

## COMPUTER PROGRAMS

COLORADO SPECTRUM,  
INC.

## R/C:PC

Finally! A comprehensive PC-based tool kit for testing, analyzing and understanding your R/C equipment (even use your transmitter as a joystick with your favorite flight sims!). Software "oscilloscope" lets you monitor and test transmitter (via trainer port), receiver, batteries and servos. Decode and save transmitter mix settings. Check receiver signal accuracy. Test batteries under load. Diagnose servo binding, stalling and gear condition in or out of your aircraft. The complete R/C to PC connection! Part no. 00501

Price: \$59.95; cable sets \$9.95 each (Futaba, Hitec, JR, Airtronics).

## USR&amp;D CORP.



## AERO\*COMP

AERO\*COMP predicts how well your electric-powered aircraft will perform—before you build it! You input physical characteristics of the airplane, propellers, motors and battery pack. The program tells you takeoff rpm, current, best gear ratio, motor power, efficiency, thrust, rate-of-climb, air speed, glide ratio and other performance characteristics. Predictions are usually accurate to within 5 percent! Runs on IBM-compatible computers; features pull-down menus, on-line help screens, and data for 225 electric motors and 53 airfoils; used by NASA and by U.S. and Canadian Nationals trophy winners. Version 3.0 available now!

Price: \$79 (\$3 S&H)

## GENERAL

## AIRDROME



## Albatros D.II, Austro-Hungarian Ser. 53.06

New! Airdrome's impeccably accurate plans of this 1917 beauty in 2-inch scale are now revised for the 40-size Astro system. Span—54 inches; area—1032 square inches; total weight—130 ounces; wing loading—only 18.2 ounces/square foot. The burnished aluminum cowling fortuitously conceals the engine! Full cockpit, cable controls, fuselage details and rigging yield incredible realism, and it's a great flier! There's unbelievable lasting pleasure in building from Airdrome's plans, limited only by the depth of your love for modeling! Richly illustrated documentary album—\$10 plus \$3 shipping.

Part no. B-1 (2 sheets)

Price: \$44 (add \$4 for rolled plans).

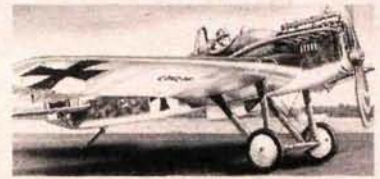


## Focke-Wulf Fw56 Stösser

New! After Stratt's "Interim" mixed scale test model won 1st in scale at the KRC '94, he completed his real goal: the new 2-inch scale version for an Astro 40 Cobalt geared system. This handsome hawk-like parasol is now more powerfully agile! Flown by WW I ace Ernst Udet, it was a star aerobatic performer during the "Golden" '30s at U.S. airshows. Nimble and sturdy, it later trained most Luftwaffe fighter pilots. Superbly detailed, with plug-in L.G. and "glow" adaptation. Span—70 inches; area—630 square inches; wing loading—21.4 ounces/square foot; radio req'd—4-channel.

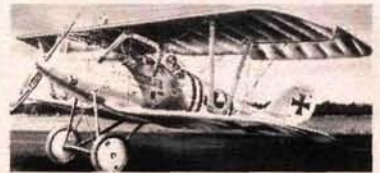
Part no. B-8a (2 sheets)

Price: \$44 (add \$4 for rolled plans).

Junkers J2  
Ser. E-252/1916

New! Enjoy building and flying an amazing piece of history! Note the world's first thick, internally cantilevered wing and its incredibly advanced overall clean lines! Fokker tested it and later got his D.VIII's wooden version of it via Forsmann in 1918. Note the earliest known belly radiator, excellent for our battery! Now in 2-inch scale for .40-size Astro system; span—72 inches; area—1060 square inches; total weight—120 ounces. Wing loading is a trainer-like 16 ounces/square foot. Building skill level is medium for almost all of Airdrome's models. Part no. B-6 (2 sheets)

Price: \$44 (add \$4 for rolled plans).

Pfalz D.III/1917  
Ser. 8033/17

Airdrome's plans lovingly celebrate this elegant German fighter in 2-inch scale for the 40-size Astro system. Span—63 inches; area—952 square inches; total weight—125 ounces; wing loading—only 19 ounces/square foot! The usually superb detailing of Airdrome's plans cover the dummy engine, full cockpit, rigging and cable controls. Whether you aim for museum quality or "stand-off", you'll always end up with a unique, realistic, great flying scale model with the proven reliability of electrics.

Part no. B-10 (2 sheets)

Price: \$44 (add \$4 for rolled plans).

RWD-8 (PWS)  
Polish Trainer

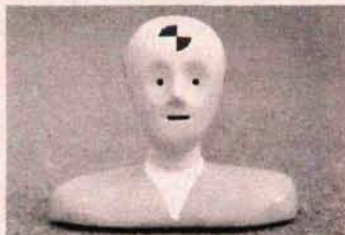
New! Airdrome constantly revises its plans to achieve the latest electric power developments. This sturdy, agile parasol is now in 2-inch scale for the 40-size Astro system. A joy to build and fly competitively, it spans 70 inches. Area—862.5 square inches; total weight—125 ounces; wing loading—only 20.8 ounces/square foot. All Airdrome's plans show full wings, all ribs and formers, etc., and may helpful hints. Included also are supplemental sheets, 3-views or tech ref. markings, rigging and circuit diagrams.

Part no. B-7 (2 sheets)

Price: \$44 (add \$4 for rolled plans).



## BOB DIVELY MODELS



## Crash-Test-Dummy Pilot

Bob Dively Models has given you a new excuse if your plane hits the ground, a tree, a rock pile, a car...you get the idea. If you had a crash-test-dummy pilot in the plane, you could call it a high-speed impact test. This 1/5-scale pilot is available through Great Planes, or order directly from Bob Dively Models. Call for more details.

Price: \$4.95 plus \$1.50 shipping.

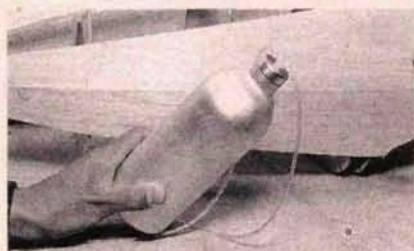


## Stuka Dive Bomber

One of the most interesting-looking war-planes of WW II. Specifications: wingspan—69 inches; fuselage—53 inches; engine req'd—.60 to .90 2-stroke; weight—7 to 8 pounds. Features include a scale cockpit; greenhouse canopy; exterior details and bombs; glass fuselage; cowl and wing fairings; foam outer wing panels. Available from Bob Dively Models. Send \$3 for catalogue.

Price: \$249.50 plus shipping.

## BODDEN MODEL PRODUCTS



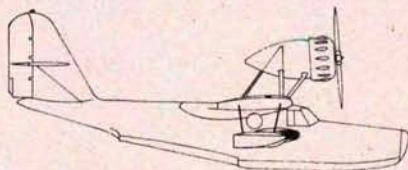
## Safe-Tank

No more exploding plastic air tanks! Bodden Model Products introduces a new line of air-borne air storage tanks. Called the Safe-Tanks, these all-aluminum tanks are tested to 300psi and samples are burst-tested to 600psi for a safe working pressure of 100psi. The Safe-Tanks come in three sizes for use in larger planes to handle the high volume of air required for big retracts. Sizes range from 2.5-inch diameter x 6.5-inch length to 3-inch diameter x 10.5-inch length.

Part no. BP501; BP502; BP503

Price: \$32.95; \$34.95; \$36.95

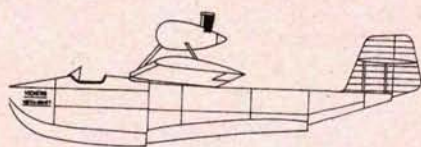
## CHARLIE'S



## Fleet wings Seabird

Never before kitted, this 1-inch to 1-foot true scale model comes with motor, prop, wiring harness and switch. Kit also includes vacuum-formed nacelle, gear fairings and tip floats. Contest-grade balsa, of course, and rolled plans with 3-views.

Price: \$39.95 plus shipping

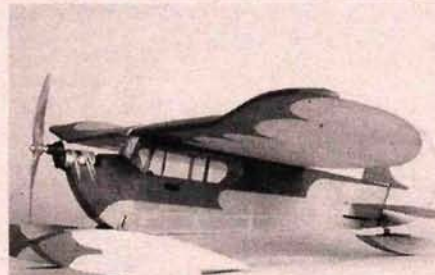


## Vista Genet

One inch equals one foot on this gorgeous scale model of a one-of-a-kind prototype sea plane, developed for the Canadian forest service as a fire spotter and resources management tool. The kit comes with motor, prop, vacuum-formed nacelle and tip floats, as well as a wiring harness and switch. Rolled plans and contest-grade balsa, of course!

Price: \$37.95

## CLANCY AVIATION



## Electric Lazy Bee

The electric Lazy Bee offers electric fliers the same amazing low-speed performance and handling that the original Lazy Bee is still known for. The wingspan has been extended to 48 inches, which increases the wing area by more than 20 percent. Typical wing loading is 9 oz./sq. ft.! The stall speed is very low: the Lazy Bee does loops and rolls at speeds where most planes fall out of the sky! Floats sold separately. Motors: .035 to .075.

Part no. Lazy Bee Kit

Price: \$60

## COX HOBBIES INC.

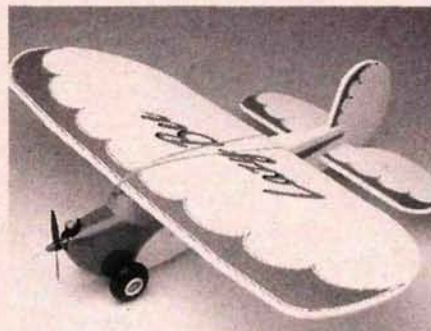


## Katydid

Featuring Cox's "Ready Built Balsa and Film Construction," the economically priced Katydid offers the novice flier a terrific training opportunity. Yet with three channels for rudder, elevator and throttle, plus a steerable nose wheel, this breakthrough in model aircraft can still challenge the experienced pilot. Factory-built components provide easy assembly. Specifications: wingspan—41 inches (787 mm); length—28 inches (711 mm); wing area—265 square inches (1710 sq. cent.).

Part no. 7100

Price: call



## Lazy Bee

The molded poly foam construction and large control surfaces on this unique model plane provide extremely smooth and graceful flight characteristics. It can be flown in a very small area, and it actually takes off from the ground. An oversize fuel tank allows extended flying time! Powered by a Cox .049 engine with Snap Starter®, and controlled by a new compact 2-channel, 2-stick (rudder/elevator) proportional radio transmitter. Produced under license from Clancy Aviation. Specifications: wingspan—39 inches (991mm); length—32.75 inches (832mm); wing area—480 square inches (3097 sq. cent.).

Part no. 90451

Price: call



## COX HOBBIES INC.



## Scorpion

The Scorpion offers the intermediate flier an opportunity to step up to the excitement of full aerobatic flying. The Scorpion ARF includes factory-built components for quick assembly, and is covered with a top-quality medium temperature film. A complete set of decorative stickers is provided, or you can decorate the model yourself. This ultimate high-performance model requires a 4-channel radio (not included) for rudder with steerable tail wheel, elevator, throttle and ailerons. Designed for the powerful Cox Tee Dee R/C .09 engine (not included), this incredible plane will execute full aerobatic routines and more!

Part no. 7200

Price: call

## CS FLIGHT SYSTEMS



## Electric-Flight Catalogue

This catalogue is loaded with electric-flight equipment and supplies for all modelers at discount prices. There's even a bonus section of compiled electric-flight information that beginners will find especially helpful. You can also special-order from the Ace R/C and Hobby Lobby catalogue and save.

Price: \$7 (U.S.); \$8.50 (Canada); \$10 (overseas).

## FLY-RITE MODELS



## FliteMaster

This large scale racer features short takeoffs and landings, is very stable and is difficult to stall. The wide-chord, tapered wing permits sharp maneuvers at low and high speeds. An all-wood kit, consisting of machined pine, plywood and balsa parts. The kit includes quality hardware, fiberglass cowl and wheel pants, canopy, rolled plans, sample Balsa USA CA glue and detailed instructions. Specifications: wingspan—81 inches; wing area—1677 sq. in.; length—86 inches; engine req'd.—2.75 to 3.78cid. Order from Fly-Rite Models.

Part no. FliteMaster

Price: \$478.95

## LITE MACHINES CORP.



## LMH-100 Helicopter

Radical aerodynamics enable you to fly this durable helicopter with a Cox TD .049/.051! The rugged, injection-molded main rotor has semi-flexible plastic blades that fold upward in a crash. Easy to build, the LMH-100 has far fewer parts than other helicopters. The kit includes a patented Arlton gyro on the tail rotor, a machined clutch and heat sink for the engine, and detailed, step-by-step, illustrated manuals. It requires a 4-channel airplane radio with Deans antenna and microservos, TD .049 or .051 engine and an Ace throttle sleeve.

Price: \$199

## MAKIN' MODELS

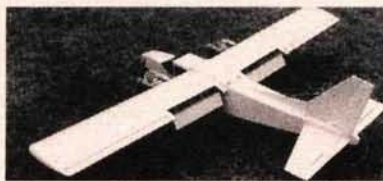


## Scale Cockpits and Pilots

Makin' Models offers scale cockpits and pilots, available in many sizes or depictions. They're designed for utmost realism. Each pilot is handcrafted, painted, spin casted urethane resin. We offer a Look-A-Like option and a celebrity pilot of Patty Wagstaff in several sizes. Our cockpits fit most kits and scratchbuilder needs. Available prebuilt, painted, or unassembled.

Price: call

## NORTHERN WINGS



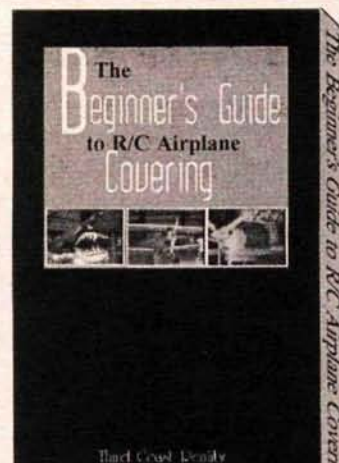
## Kestrel

This tricycle-gear, twin-engine trainer has exceptional short takeoff and landing characteristics due to the easy-to-install Fowler-type flaps. The kit features conventional balsa-and-ply construction, pre-cut parts (no die-cutting), a hardware package and high-quality, one-piece vacuum-formed parts. The detailed plans and the photo-illustrated assembly and flight manuals are clear, concise and easy to follow. Specifications: wingspan—72 inches; engine req'd.—.25 to .28; radio—4 or 5 channel.

Part no. NW93002

Price: \$129.95

## THIRD COAST REALITY



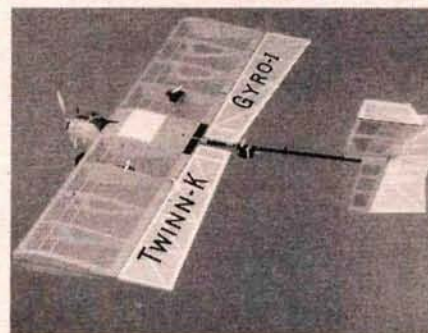
## "The Beginner's Guide to R/C Airplane Covering"

This video enables novices to learn the fundamentals of covering model aircraft and to get professional-looking results. "The Beginner's Guide to R/C Airplane Covering" includes an easy-to-follow demonstration of the techniques you need and the tools you require to achieve a wrinkle-free surface. Covering your model can be one of the more enjoyable parts of the hobby. Don't be overwhelmed; this step-by-step visual guide will give you the confidence you need to cover your model competently—with lasting results.

Part no. 42

Price: \$29.95

## TWINN-K, INC.



## Gyro-1

Gyro-1 by Twinn-K gives hours of thrills and pure enjoyment to fun fliers. Weighing less than 3 pounds when fully equipped, this plane is light, maneuverable, stable and fun to fly. It can be built in a weekend. Excellent slow-speed stability. Use a 4- or 7-channel radio, and watch this plane perform. A .25- to light .40-size motor is recommended. Call your local dealer or Twinn-K directly. 10 percent off to AMA members.

Part no. Gyro-1

Price: \$89.95





### Lightweight Airplane Tires

New this year from Twinn-K are lightweight, low-bounce airplane tires, aerodynamically cut to help pilots maneuver their planes in the air and on the ground. Eight sizes are available, from 2 1/4 inches to 4 inches. Mount these tires on electrics, old-timers, big bombers or fun-fly airplanes. The unique feature—a thin o.d.—makes these tires popular and useful. Contact your hobby dealer, or call Twinn-K directly for size and price information.

Part no. various

Price: various

### ULTIMATESPORT RC



### Team Sukhoi Accessories

Jackets \* Shirts \* Hats \* Pins  
For Sukhoi fliers, owners, etc. Ultimatesport R/C has items to make you a part of Team Sukhoi. The nylon jackets have an embroidered 9-inch Sukhoi going vertical on the back with "Team Sukhoi" above the right wing. On the front are a smaller Sukhoi and your name. The golf shirts are also personalized with a small Sukhoi on the right. The hats have a Sukhoi with the words "Team Sukhoi." High quality and detailed embroidery on all items.

Price: \$74.95 (Jackets); \$39.95 (shirts); \$15.95 (hats); \$5.50 (pins).

### WENDELL HOSTETLER'S PLANS

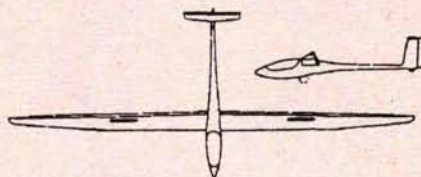


#### Plans

Wendell Hostetler's Plans, since 1979, features an historical selection of Giant Scale aircraft dedicated to the sport flier. Each detailed plan sheet provides a traditional approach to building using all-balsa construction with some plywood and basswood. All designs are test-flown before final construction drawings are released. Designs include selections from the Golden Age era, up to and including modern unlimited and Formula 1 racers. For additional information, send SASE.

Price: send SASE

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Windspiel Models is an importer of fine R/C scale sailplanes and a dealer for JR radios. Quarter-scale kits are available now: ASW 24, ASH 25, ASH 26 and ASW 27. Other models are also available. Send \$10 for a full color catalogue (in English).

Part no. various

Price: various



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# GOLDEN AGE OF R/C



H A L D e B O L T

## ENTERPRISING R/C'ERS

AS TIME PASSES, we see changes; some are welcome and others separate us from what was long cherished and appreciated. An example of the welcome new is Byron Originals'\* impact on giant-scale modeling. We can only hope that they'll be with us as long as our two staple sources—Sig Mfg.\* and Ace R/C\*—have been.

To appreciate what Sig and Ace represent to the modeling world, you must go back to the very early days when models and R/C were built, not bought. Early on, airplane kits were rare and, really, not "the thing," so scratch-building was a necessity.

Fortunately, Glenn Sigafoose (Sig Mfg.) saw the need for model materials and established what became a "supply depot" for all modeling needs. Of course, as modeling progressed, Sig expanded to meet increasing demands. It was a sad day, at least for OT'ers, when Hazel Sig Hester retired recently. Her lovely smile and cooperation **will** be missed!

Ace R/C's temporary hiatus from manufacturing scared many; fortunately, as with Sig, new people have taken over the reins, and R/C'ers welcome them.

### MANUFACTURERS WITH VISION

To appreciate Ace, you have to go back to the advent of citizens-band and the R/C explosion. For a number of years, if you were into R/C, you built your own system, often from scratch. Most often, some electronic guru would publish a construction article (his latest brainchild) in one of "our" magazines; *Model Airplane News* was a leader. On the fringe of the hobby, there were also

many "electro types" who were trying to develop a better R/C mousetrap. If you needed an airplane, the hobby shops or Sig had the materials. If, however, you were looking for electronics, that was out of the hobby shop's realm.

Paul Runge recognized the need for



Note the modern look of Lou Proctor's 60s-era Bolero biplane and how it contrasts with his famed Antic. A fine modeler, Lou's low-key approach to the hobby belied his exemplary efforts.

R/C electronic components (many of which had a special nature owing to the weight and size restrictions). I don't know how Paul planted the seed, but it soon became apparent that if you needed an "XYZ" tube, capacitor, coil, resistor, or whatever, "Ace was the place."

As the popularity of building from magazine article plans grew, Paul saw the advantage of packaging the necessary components for particular units. The idea progressed to become "kits," which were complete and included instructions. One could say that Ace became the "Heath kit of R/C."

Today, we recognize Ace R/C as a general supply house for most R/C needs and, in recent times, as a model kit manufacturer. Unless you have their extensive catalogue, though, you may not realize that they also still offer as many electronic bits and pieces as they always have.

### GRID LEAKS

Today, most of our hobby magazines include R/C; *Radio Control Modeler*

and *Model Airplane News* are exclusively R/C. As with all things, this trend had a beginning—somewhere.

It's hard to imagine the widespread efforts of individuals across the world that went into R/C development. We needed a way to spread the word about R/C accomplishments and developments. A New Jersey R/C club made what seems to have been the initial organized attempt with their *Printed Circuit* newsletter, which was many pages long and edited by Art Schroeder (whom we all know as R/C's unfaltering friend). There is, however, always a limit to what part-time volunteers can do; but *Printed Circuit* served us very well!

To spread the word more efficiently, Paul Runge created a magazine that was devoted to R/C. In tune with the times, he aptly named the publication *Grid Leaks*. Where did he come up with the name? Before the days of transistors and computer chips, modelers used tubes that

(Continued on page 110)



## RADIO CONTROL and Model Aircraft WORLD

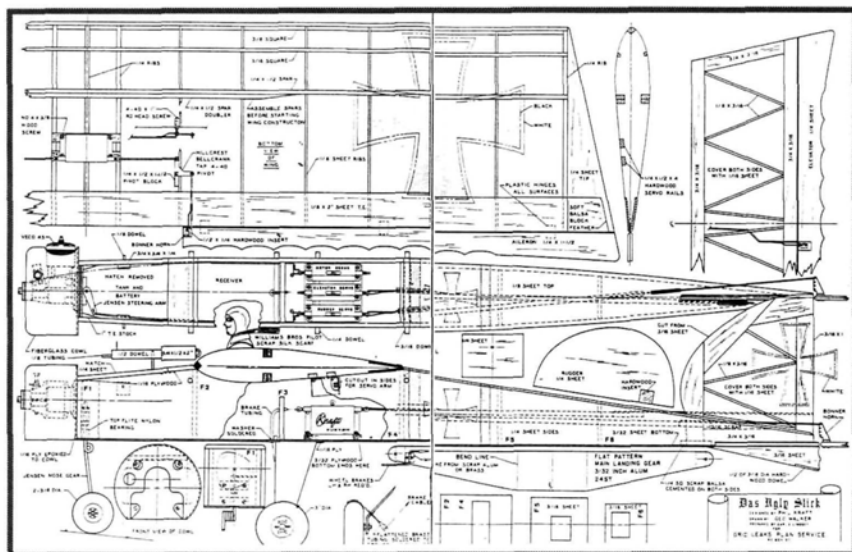
VOL. 7, NO. 3 MAY-JUNE 1968 35 CENTS



The original version of Phil Kraft's everlasting design.



## GOLDEN AGE OF R/C



This is the original *Grid Leaks* plan of the *Ugly Stik*; note the simplicity of the structure; only stock-size balsa is needed.

had plates and grids. *Grid Leaks* quickly became the R/C "bible," and many people eagerly awaited each issue. If you were to read a few excerpts from the magazine you'd appreciate the R/C atmosphere of those days. The ads were interesting, too; in a 1966 issue one offered the "new MonoKote" as the savior of all modelers. In effect, it declared that we could forget our silk and dope. How true that turned out to be!

During this time, the great search was on for multi-control systems. Reed systems were too expensive for most modelers, so the desire was great for something that was reasonably priced and could easily be adapted to equipment already on hand. *Grid Leaks* was full of ways to exploit single-channel controls, mostly with Galloping Ghost and pulse-style systems.

A '62 issue advertised a superhet reed receiver that was superior to the super-regenerative types that were common then. It

## HOG WILD!

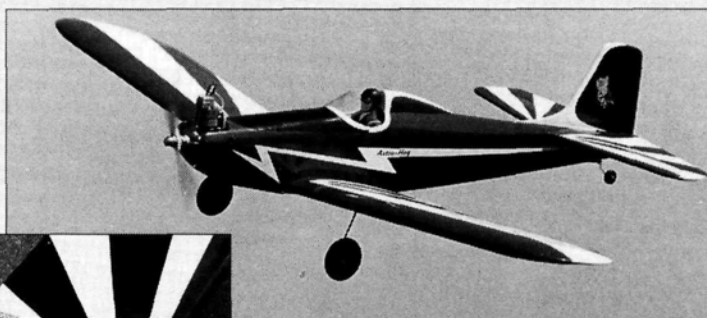
Our discussion has reached the beginning of our modern era. We'll now consider the Astro Hog, which was the culmination of all that was built before it.

At the '57 Nats, there were no low-wing designs; then, just one year later, the '58 Nats was flooded with Astro Hogs! In that one year, this exciting design really got everyone's attention! What suddenly made it possible? If you've followed my evolution, you're aware that advances occurred rapidly. First, a reliable multi-channel system was a must, and the development of the reed system filled that need. Then, the usefulness of ailerons and symmetrical airfoils was proven. The potential of a low-wing design was just waiting to be discovered by some visionary modeler.

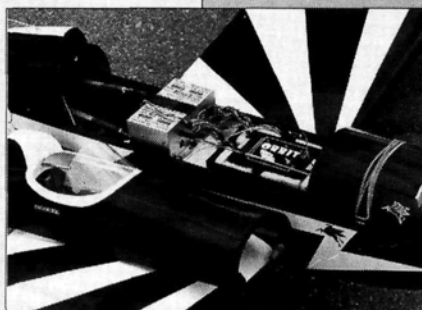
The story is that Fred Dunn, of C/L Di-Do fame, was unable to travel to the '57 Nats with his Californian buddies. He wanted to make up for that so, while they were gone, he took a long look at the favorite Smog Hog and felt that he could improve it by moving its wings to the bottom. Apparently, when the crew returned, he had the prototype flying, and it demonstrated astounding performance compared with the high-wing version. The die had been cast, and everyone just had to have the new bird, which

was labeled the "Astro Hog."

The Smog Hog was noted for its docile behavior, so it



Mike Gretz's faithful replica of Fred Dunn's original *Astro Hog*.



The Orbit reed system in an original *Astro Hog* (note Bonner's first reed servos). When the hatch fell off while the plane was inverted, Dunn's *Astro* crashed!

was no surprise that Fred had used the Smog's aerodynamics. The low-wing version remained docile, but maneuverability increased drastically. When we see Astro replicas flying today, it's obvious that the ability of this 35-year-old is on a par with many of today's offerings.

Structurally, Fred's Astro Hog wasn't nearly as simple as the Smog Hog. If anything, it was the opposite; there were all

sorts of ways to add more parts.

For those who enjoy flying OT R/C, the Astro Hog is an excellent choice. Who offers the kit? Sig Mfg., of course; they offer a fine replica kit.



came as a kit or ready to use. Super-regen circuits were interference-prone, so superhets were a great help and are still used today.

Interference was a lingering problem because CB activity was the rage and was cluttering our 27MHz band. Frank Schwartz offered a monitor that would allow you to check for interference before flying!

In a '66 issue, Kraft raved about their 4-channel propo system and proudly announced a 6-channel version. E.K. offered a similar system. Propo, however, was still a "hard sell" because so many modelers had already laid out big bucks for a reed system that had quickly been outdated by a new \$500 to \$600 system. Many wondered where it would all end. Also in '66, Lanier RC offered the first ARF—the Transit trainer.

Is there anyone who hasn't had an Ugly Stik of one sort or another? Do you know how it got its name? When modelers were "busting" airplanes trying to sort out new propo systems, they needed something simple to work with. With only a few lines on paper and a pile of "stock" balsa, the first Ugly Stik was created almost overnight. Flight tests amazed by-standers and produced better results than had been expected. Bystanders commented, "How come something so ugly performs so well?" Thus, the Ugly Stik was born; and everyone wanted one. Phil thought that it needed some pizzazz so, because it resembled an Emdecker, the WW I plane's time-honored features were added to the model. Would anyone care to guess how many of these admittedly ugly, yet fine performing models have flown?

In so many ways, Ace R/C is part of our heritage, so we must thank Joe Kessinger, as well as the new Sig people, for carrying on for us.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 170.

## VENTURE 60

72" WINGSPAN  
876 SQ. IN.  
7.25 LBS.

.60 - .65 2-Stroke  
.65 - .80 4-Stroke



This classy sport model flies as gracefully as it looks. All of the kit parts are accurately machine cut - No die cutting! The Lite-Ply fuselage snaps together and the simple wing is strong and light. Kit includes Sig balsa, canopy, aluminum landing gear, rolled plans, instructions, decals, Easy Hinges, hardware.

### BRUCE THARPE ENGINEERING

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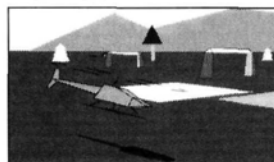
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HOW TO

# Improving Flight Performance Part 1

*Winning the war against poor lateral controllability*

by CARL RISTEEN

**M**OST OF US have occasionally encountered an evil handling, just plain nasty airplane. After trying the usual fixes, including adjusting the center of gravity and the thrust line and fixing obvious warps without much effect, you may decide that the thing is just a dog; you stuff it into the trash barrel after a crash (when it could have been repaired) or sell it cheap.

That "touchy" model that bites you at the slightest provocation probably suffers from a common airplane behavioral disorder—poor lateral control. This should not be confused with poor lateral stability, which elicits behavior that ranges from dangerous to delightful. Lateral control and lateral stability, like the well-known amorous porcupines, are inclined to have a prickly relationship. More on that later. First, let's define these terms so everyone will know what I am talking about.

## LATERAL CONTROLLABILITY

"Lateral" means sideways, or pertaining to a side. According to Newton, persuading an airplane to turn to one side requires a sideways force. The wing generates force far more efficiently than a skidding fuse-



*First flown in 1936, the Fieseler Storch is a prime example of a design that used full-span flaperons and fixed leading-edge slots to retard tip-stall and increase aileron effectiveness at low speeds. (Photo courtesy of Bob Bank's Scale Model Research\*.)*

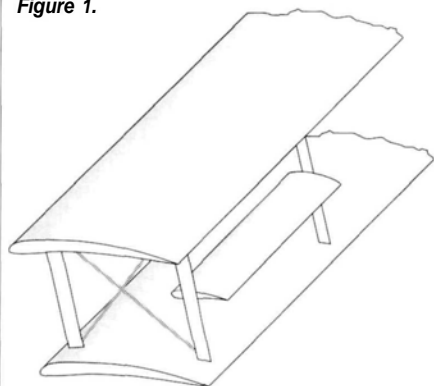
lage. Getting the wing to generate a sideways force, in addition to its vertical lifting force, requires banking, and this, in turn, demands roll control; so, in airplane lingo, lateral controllability usually pertains to rolling.

We need good roll control for clean turns and aerobatics, but an airplane that perversely rolls over onto its back, as if to play dead, frequently becomes just that—violently! Gamboling a little sideways like a romping puppy generates additional drag and isn't pretty, but it isn't usually a mortal sin. Abrupt, yawing lurches are another

story. At low air speed, sudden, squirrely moves generate large differences in air speed between the left and right sides that can completely overwhelm a hard-working wing.

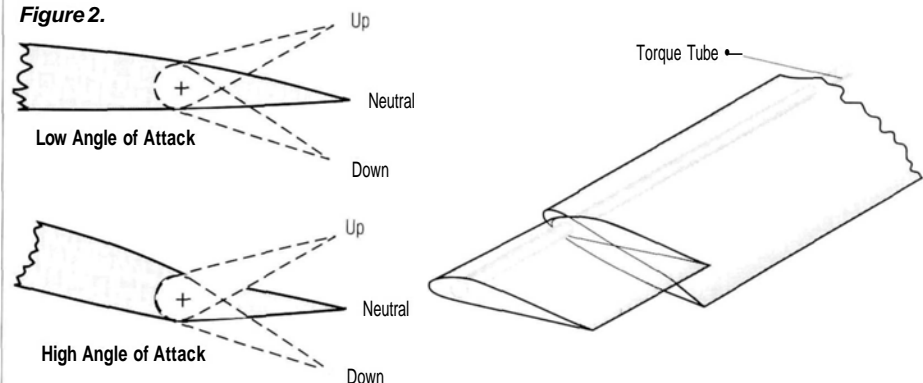
Lateral controllability means how the airplane responds to your command to roll. Good lateral controllability means predictable, solid response to aileron input. Poor controllability typically starts with drunken yawing that, if unchecked, proceeds to rolling inverted and a kamikaze attack at the runway.

Figure 1.



*Very early (circa 1905) aileron/wing arrangement; aileron completely separate from wing; much less effective than aileron at wing trailing edge.*

Figure 2.



*Floating aileron. Ailerons free to "float" up to align themselves with slipstream, thus reducing the drag of the lowered aileron. For an aileron with 30% of the wing's chord, tests showed an approximate 50% reduction in adverse yaw. Unlike Frise ailerons or slots, floating ailerons work well in inverted flight, but with some loss of lift. The rotating-wingtip version is an extreme variant that's seldom used because it's complicated and heavy and incurs more loss of lift.*



## LATERAL STABILITY

If you simply return its controls to neutral, a laterally stable airplane will do its best to return to wings-level flight when it's upset by a wind gust or ham-fisted piloting. This sort of behavior may not be to your liking, but it makes for a forgiving trainer. Unfortunately, the poor airplane is too dumb to know whether it is being upset by a wind gust or a pilot command, so it tends to stubbornly resist both. Conversely, precise aerobatic flying requires that the plane be coaxed into all sorts of attitudes, far from straight and level, and forced to stay there without argument. Stability in aerobatics is like a demolition derby starring Ralph Nader as the leading "leadfoot."

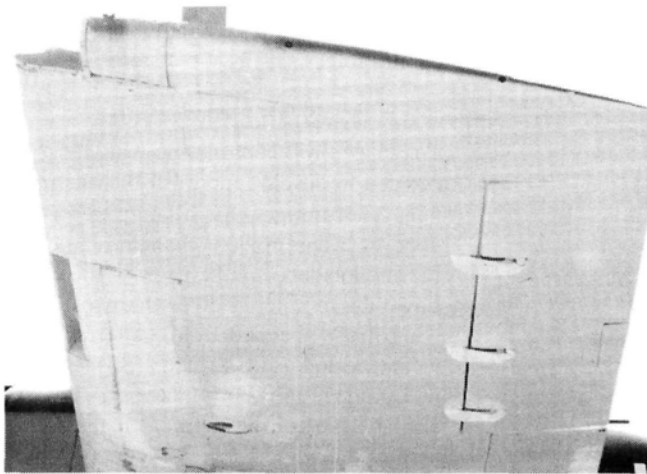
An error-forgiving trainer-type model that usually has good hands-off self-righting stability tends to be less controllable laterally than a neutrally aerobatic model. The kicker is that a laterally stable model may, perversely, become highly unstable under the influence of the large aileron deflection it demands when the wing is close to stall. And it can also be more of a handful in rough air when crosswind gusts produce a lot of unwanted roll and turn it away from its intended heading. Serious aerobatic machines should exhibit virtually no lateral stability, but they must compensate with superb lateral controllability, predictability and tenacious line holding, even if that line happens to be aimed straight at terra firma.

## AILERON EVOLUTION—UPS AND DOWNS OF EARLY AILERONS

Ailerons usually shoulder the brunt of the lateral control task. These deceptively simple-looking devices have chewed up years of toil by the best brains in the business, yet they continue to spit out bruised egos and broken airplanes.

"Aileron" is the French word for the end

of a bird's wing. The airplane aileron was invented in 1868 by English ornithopter (flapping-wing airplane) enthusiast M.P.W. Boulton. Had this ingenious pioneer been cagey enough to sit on his patent application for about 35 years, a jumbo-jet load of royalty gold might have fallen into his lap. But this was not to be. Poor Boulton's work languished unnoticed. He



*The Grumman Avenger features slotted wingtips that enable the tips to resist stalling, even after the inboard portion of the wing has stalled. The tradeoff was considerable drag. (Photo courtesy of Bob Bank's Scale Model Research.)*

had buried his aileron work under a flock of other ornithopter schemes; the aileron had to wait until about 1905 to be rediscovered, and airplane people are still struggling to get it right.

The Wright brothers stood virtually alone in recognizing the crucial importance of aerodynamic lateral control. They saw clearly that control by weight shifting, though adequate for primitive hang gliders, would be suicidally feeble for heavier and faster machines. Airplanes, like circling birds, would need to bank in turns. Wilbur Wright observed buzzards warping their wings to combat bank-angle upsets in rough air. He knew a good thing when he

saw it, and he suited up a glider with wing-warping control. It worked wonderfully. Aerodynamic lateral control for airplanes was hatched, courtesy of the ancestors of a few Ohio road-kill gourmets.

Although ridden by practical difficulties, low-drag wing-warping control has long intrigued aerodynamics purists. Some pilots endured early WW I combat with tricky-to-rig wing-warping control. At high speeds, it could become too light, or very heavy. Both extremes tired pilots, and fatigued pilots were easy prey. Serious mishaps drove home the point that making a wing torsionally flexible enough for light and responsive warp control also tended to make it flex and twist excessively at higher speeds. Flutter was a particularly puzzling and lethal affliction. Wing-warping proponents threw in the towel,

defeated by the stone-ax simplicity of ailerons. Biding their time, the buzzards reserved comment.

Wing warping has appeared sporadically over the years, chiefly on sailplanes, where its super-slick aerodynamics beckon seductively. It may rise again in the next generation of ultra-tech jet fighters. At supersonic air speeds, moving an entire flying surface serves up much stronger control than moving separate control surfaces.

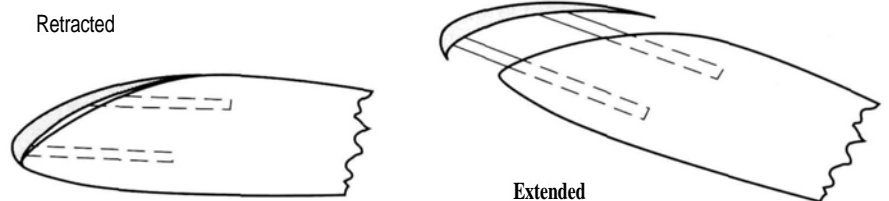
Hanging a simple appendage on the rear of the wing is less aerodynamically "sanitary," but far simpler than warping the entire structure. The earliest ailerons, how-

Figure 3.



*Fixed-wing slot. The slot in the wing's leading edge ahead of the aileron retards tip-stall to a much higher angle of attack and maintains aileron effectiveness by keeping the tips up-stalled, even when the inboard wing area is in deep stall; drag is high.*

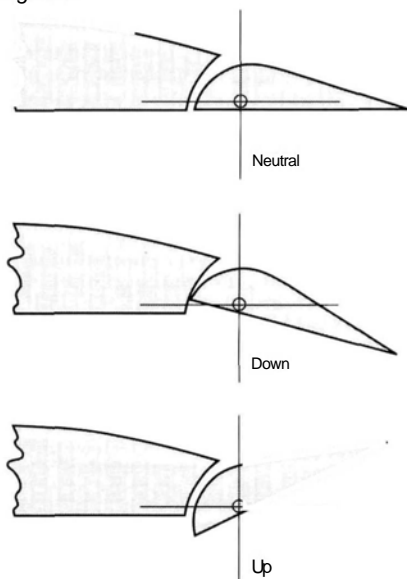
Figure 4.



*Automatic slot. At normal angles of attack, the slot is kept closed to reduce drag, which would be greater with a fixed slot. To keep wingtips unstalled and maintain aileron effectiveness at a high angle of attack, the slot extends automatically in response to the change in pressure distribution.*

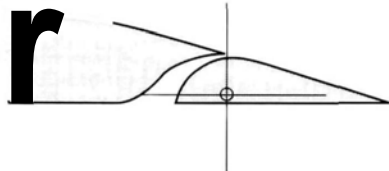


Figure 5.



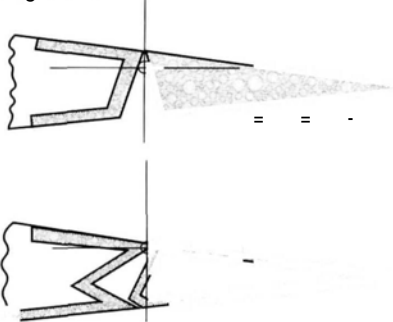
*Frise aileron section. In the "up" position, the sharp leading edge projects down into the air stream and produces extra parasitic drag that helps to counteract the induced drag of "down" aileron. For good aerodynamic balance, the hinge axis is about 20% of the aileron chord behind the leading edge; 75% less servo load than conventional aileron. The leaky gap necessitates an area that's 20% to 30% more than that of a conventional aileron for the same rolling moment.*

Figure 5a.



*Slotted aileron. Tests showed about a 50% reduction in adverse yaw for an aileron with 25% of wing's chord, at a twist of 15% loss of rolling moment compared with a conventional aileron.*

Figure 5b.



*Sections show (top) the airfoil commonly found on models and (bottom) the drag-reducing fairlead-gap design favored by the author. If a Frise effect is desired, the aileron leading edge can be extended farther and sharpened.*

ever, were independent small airfoils that were completely separated from the wings (Figure 1). Airplane tinkerers quickly discovered that attaching the things to the wings' trailing edges yielded far better results. There, by influencing the pressure distribution over a major portion of the wing's chord, they could produce vastly greater aerodynamic control forces.

## HOW AILERONS WORK

To achieve roll control, one wing must be coerced to develop more lift than its partner. Ailerons get this all-important job done by rather crudely changing the camber and incidence of their part of the wing. Lowering an aileron gives the part of the wing that's spanned by the aileron more incidence and camber. Increased incidence will produce more lift and, thus, give the airplane the rolling moment it needs, as long as the wing's angle of attack is comfortably below the stalling angle. Trying to get more lift from a wing that is already giving its all will simply force it to stall and produce less lift and a lot more drag—producing a roll in the reverse direction. Increasing airfoil camber helps here by increasing the maximum lift the wing can produce.

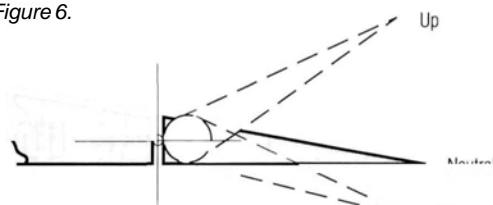
By the mid-1950s, multi-channel R/C opened the door to aileron lateral control. To reduce its lateral stability, Bob Dunham converted Howard Bonner's 1956 Nationals-winning Smog Hog into a low-wing configuration, and he also added ailerons. We have never looked back.

## HOW AILERONS DON'T WORK Yaw-Inducing Drag— The Aileron's Achilles' Heel

A fundamental law of aerodynamics asserts that if we want lift, we must pay with drag. There is no free lunch. Lowering an aileron, even one as aerodynamically slick as a banana peel, to coax more lift out of a wing panel must increase the drag of that panel. This induced drag tends to yaw the airplane toward the wing with the lowered aileron and turn it the wrong way. Wing warping is less "draggy" than the best of ailerons, but it still gave the Wright brothers drag/yaw headaches.

Remember: induced drag is proportional to the square of lift at a given air speed. Getting 20 percent more lift out of a wing panel exacts a toll of 44 percent more induced drag. Induced drag is usually neg-

Figure 6.



*Differential aileron travel—a popular, simple "fix" for aileron-induced yaw. The reduced "down" travel reduces the induced drag that's caused by lowering an aileron; common in full-scale, "up" travel is two to three times greater than "down" travel. Needs fine-tuning to find the best balance between yaw reduction and its byproduct: roll/pitch coupling.*

ligible in straight-line, high-speed flight, but it's dominant at the high lift coefficients needed at minimum flying speed. The result is aileron-induced yaw that the vertical tail, handicapped by working in slowly moving air, may be unable to resist. Dihedral acts in evil concert with yaw to produce a rolling couple that the ailerons may be unable to overcome. Aileron control may quit completely, or even reverse and drop your airplane on its beanies.

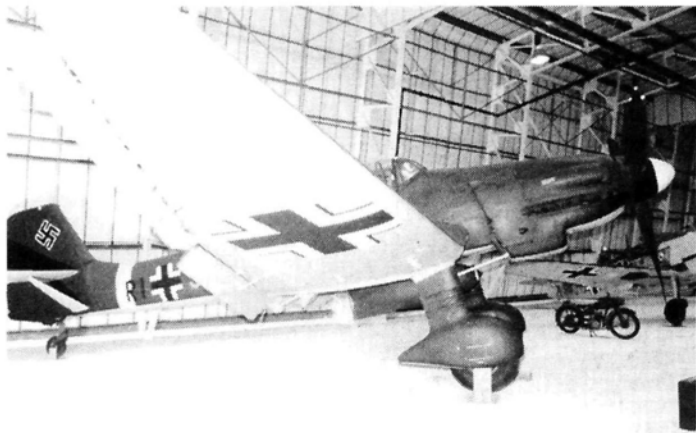
Observing that lateral control tends to go away as an airplane approaches stall, some designers have attempted to produce a stall-proof airplane. Keeping the CG well forward and using elevators too small to develop enough force to stall the wing can do the trick—at least, most of the time. The problem is that the airplane's maneuverability is reduced and takeoff and landing speeds are increased considerably. Most R/C trainers lean in this direction and get by with rather crude lateral-control systems.

## AILERON DRAG FIXES

During decades of battling the fundamentally incurable aileron-drag disease, designers have concocted numerous palliatives. Some of the more helpful (or interesting) of these follow:

- **Floating ailerons** (Figure 2). These ailerons are cleverly rigged to be free to "float" upward or downward and thus align themselves with the slipstream. They can be deflected by the pilot relative to each other only, not to the wing. At high angles of attack, they float upward considerably, reducing the wingtips' effective angle of attack and thus helping to stave off tip stall. They produce lateral control effectiveness that is near the top of the list, and they also work just as well in inverted flight—a rarity among aileron anti-yaw fixes. The tradeoff is some loss of lift. An extreme example of their use is the Curtiss Tanager, winner of the 1929 Guggenheim Safety contest. You remember it, don't you? Additional advantages are that no





*The Junkers Ju 87 "Stuka" dive bomber of the mid- to late '30s used bi-wing, external airfoil flap/flaperon controls. (Photo courtesy of Bob Bank's Scale Model Research.)*

additional lift is lost when the ailerons are deflected, roll/pitch coupling is zero, and roll rate for a given aileron area is maximized.

- **Slotted wingtips** (Figure 3). Slots in the outer portion of each wing panel enable the wingtips to resist stalling and keep the ailerons working long after the more inboard part of the wing has stalled and dropped the nose. The downside? Considerably increased drag; example: Grumman Avenger torpedo bomber of WW II—a pussycat, even in the hands of low-time pilots (ask George Bush).

- **Automatic slots** (Figure 4)—a drag-reducing refinement of fixed slots. Movable slats attached to the leading edge of each wing extend automatically by air pressure at a certain angle of attack near stall, and then retract when the angle decreases and the stall danger is over. Downside: unless equipped with oil dampers, they have a very abrupt, noisy action that unnerves pilots. Just ask any early ME-109 pilot.

- **Frise ailerons** (Figure 5). One obvious, if "unsanitary," fix for aileron drag imbalance is an aileron that produces extra profile drag when it is deflected upward to help counteract the increased drag of the lowered aileron. The Frise aileron served up forgiving, low-speed handling to many light aircraft. Ed Kasmirsky used it on his Orion—a late-'50s-era R/C multi-control pacesetter. The chief problem is that profile drag increases rapidly with air speed, but induced drag decreases just as rapidly. Drag balance is good only over a narrow range of air speed near stall, but this is exactly where it is most desperately needed. In inverted flight, the action is reversed and produces bad adverse yaw. Hinged at about 20 percent of its width behind its leading edge, it demands relatively light

control force by virtue of its good aerodynamic balance. It is probably best suited to non-aerobatic airplanes with short fuselages and long, high-positioned wings. Airplanes that have longer fuselages can get the yaw resistance they need (at a reduced drag penalty) from the fuselage sides and vertical tail.

- **Differential travel** (Figure 6)—a simple, fairly aerodynamically clean "fix" that is frequently pressed into the aileron-drag battle. To get it, you rig the control linkage to produce more "up-" than "down-" travel. It produces a rolling force couple by dumping more lift from the wing you want to lower, while increasing the drag-producing lift only a little of the wing you want to raise. Getting more lift out of a wing that is close to stall tends to produce a large increase in drag, and along with it, a heavy adverse yaw. You compromise and get most of the rolling couple by reducing the lift of the wing you want to lower. If you can get the "up-" versus "down-" travel ratio just right, you can achieve pretty good drag balance and minimal yaw. Aileron differential is, in reality, a scheme to slip in a little extra wing washout (washout will be discussed later) when the

aileron is deflected. The downside is unwelcome roll/pitch coupling. When you lose more lift from one wing than you gain from the other, your airplane tends to lose altitude and nose down in response to aileron deflection.

## AILERONS

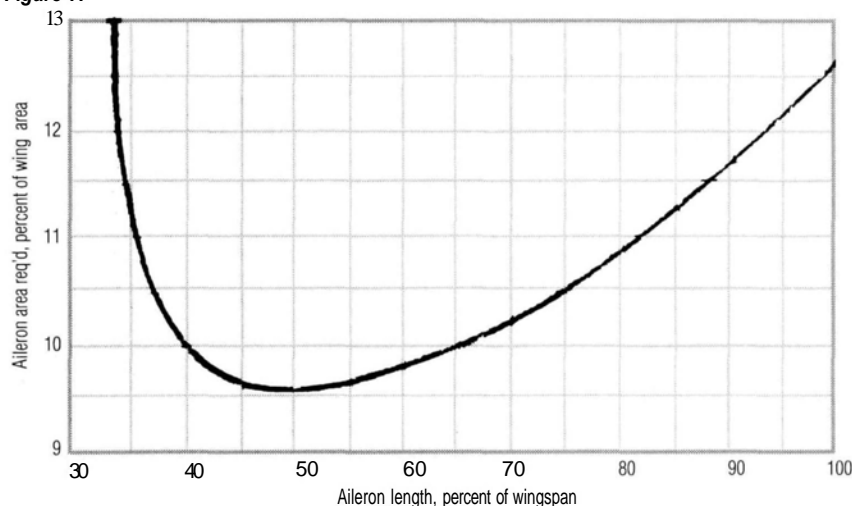
### How Long? How Wide?

Figures 7 and 8: there is no "right" aileron length or width. The ailerons on most full-scale aircraft usually span somewhere between 30 to 60 percent of the wing. Ailerons at the low end of the range may do an acceptable job if they are wide enough and the wing isn't tapered much.

Significantly tapered wings need an aileron that's a little longer but that has less total area in relation to wing area. Tapered wings roll more easily and thus produce less yaw, and the wider inboard chord leaves plenty of area for lift assist by flaps. Short ailerons are forced to squeeze the force necessary for roll control out of a relatively smaller part of the total wing area. The result is that the part of the wing that's spanned by the ailerons has to work at a higher lift coefficient that produces much higher drag. Aileron stall and more extensive tip-stall both tend to happen at air speeds considerably above a longer aileron's low-air-speed pain threshold. The aileron-less inner wing area resists roll, in effect dragging its feet and forcing the part of the wing spanned by the ailerons to work even harder.

Full-scale tests reveal that ailerons extending along about 50 percent of the wingspan need the least area. Shorter

**Figure 7.**



*Curve showing the aileron area required for a given magnitude of rolling moment, versus aileron length. Note: ailerons that cover about 50% of wingspan require the minimum area for a given rolling moment. The aileron area needed to obtain the same rolling moment increases considerably if the aileron is shortened or lengthened, although longer ailerons produce less yaw and generally provide better control.*



aileron need more area and also produce more yaw. Full-span ailerons supply the requisite control with the lowest yaw, but they need about 25 percent more area than 50-percent-span ailerons. Full-span ailerons are an uncommon combination of simplicity and performance; their popularity on models is no accident.

Ailerons also become more effective as you increase their width—at least up to something like 40 percent of the wing chord. At much over about 25 percent of the wing chord, gains start to fall off quickly. Increasing the width of an aileron reduces the slovenly angular break in the camber of the airfoil by reducing the angular deflection needed to do the job. The benefit is higher maximum control force with less drag—if you can figure a way to streamline the gap (Figure 5b).

The downside of having wider ailerons is greater overall weight and reduced torsional stiffness in the wing. Heavier ailerons also have a stronger tendency to develop flutter; you should give mass balancers very serious consideration, particularly on the faster models.

Ailerons that provide the absolute maximum roll rate at low wing-lift coefficients do not necessarily give the best control when the chips are down, near stall. In theory, roll rate should be maximized by rotating the entire wing. Some glider enthusiasts have used this slick, low-drag trick, although the lack of aileron-induced camber of the wing section may hurt control at high lift coefficients (close to stall).

Aileron area may range all the way from 5 percent of the wing area (forget aerobatics and windy-weather flying), up to more than 30 percent. Ailerons having about 15 percent of the total wing area supply enough roll control to satisfy most aerobatic needs. More is better, but heavier.

## FLAPERONS

Ailerons can do double duty as flaps. Partial-span ailerons pressed into flap duty



Figure 9. Widened inboard end of aileron improves power-on roll control on 68-inch-span biplane.

must be assisted by inboard-mounted flaps, or they're a dead loss. Without inboard flaps, lowering partial-span ailerons in unison increases the effective incidence of the outer part of the wing. This will tend to make it stall long before the inner portion and will destroy lateral control. Keeping the wingtips unstalled usually means sacrificing more lift than you gain by lowering the ailerons.

Add flaps inboard of the ailerons, and you can lower the ailerons about one third as far as the flaps—up to about 10 degrees—without hurting lateral controllability. Lowering the ailerons to greater angles may work with airplanes blessed with exemplary low-speed lateral controllability. Programming for increased aileron differential when the flaps are deployed may also work.

Remember that the reduced flying speed made possible by flaps also reduces aileron control forces. A wise modeler will test full flap extension with a new model at a safe altitude before trying a low-speed, full-flap approach.

Full-span ailerons usually aren't great performers in the role of landing flaps. Without using a lot of travel differential, they can usually be lowered only a little, say 10 to 15 degrees, before adverse yaw makes near-stall control chancy. Programming to progressively increase differential as the ailerons are lowered farther may permit considerably more flap deflection.

Flaperons on tapered wings should be given about the same taper as the wings. The use of a lesser taper will give the wingtips greater incidence than the root, and that will tend to make the tips stall first and hurt lateral control.

## ELEVATOR-COUPLED FLAPERONS

As demonstrated by control-line stunt fliers since the late '40s and,

Figure 8.

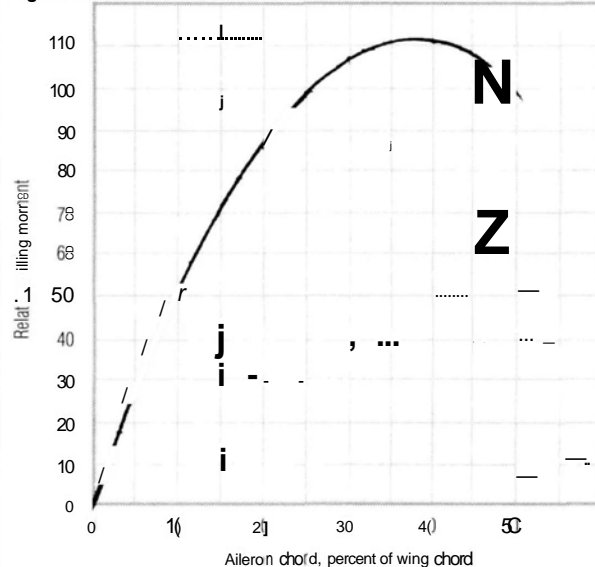


Figure 8. Curve showing the relative rolling moment provided by aileron versus aileron chord (aileron chord is expressed as a percentage of wing chord). This moment provides 1 by an aileron with 25% of total wing chord is used as reference (101% rolling moment). Note how the incremental gain in rolling moment decreases with aileron chord. An aileron with only 10% of wing chord provides more than 50% of the rolling moment of the reference (25% chord) aileron, while rolling moment increases only by about 12% when the aileron chord is increased from 25% to 35% of the wing chord (an actual 40% increase in aileron chord).

more recently, by R/C competition fliers, full-span ailerons can be used as elevator-coupled flaps for up to about a 50-percent boost in lift of a symmetrical-section wing. Just be ready for a greater loss of lateral control when the wing is giving its all.

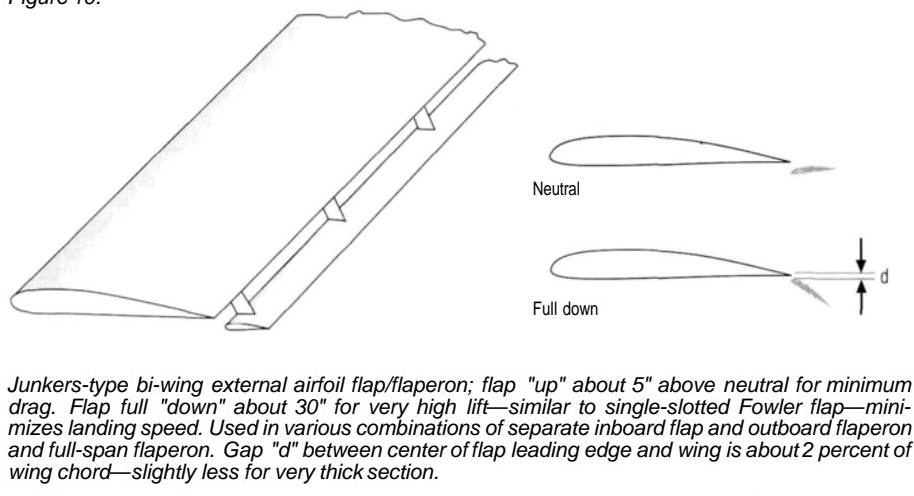
## TORQUE CANCELLATION BY FULL-SPAN AILERONS

One seldom mentioned advantage of full-span ailerons is their ability to interact with the propwash to boost roll control at high power settings combined with low air speeds. At dangerously low air speeds, those inner few inches of aileron that are engulfed in the powerful propwash can provide as much roll control as the outer 80 percent of the aileron—a big help in getting out of tight situations.

Getting enough aileron authority to allow the plane to roll against engine torque when it's pointed straight up (and hovering) may need more aileron travel than you would like for normal aerobatic flying. One trick that has worked for me is to widen the inner few inches of the ailerons—just the part that is in the propwash, plus an inch or so (Figure 9). The only tradeoff is that those widened-chord inner few inches chew up a lot of servo torque, because control-surface hinge moment is proportional to the square of the chord.



Figure 10.



### AILERON REVERSAL

Deflecting an aileron shifts the center of aerodynamic pressure rearward on the airfoil, and this tends to twist the wing in the opposite direction. The wing twist opposes the effect of the aileron. At high speeds, the wing twist can become large enough to produce a roll in the reverse direction. The only "fix" is to make the wing torsionally stiffer, paying particular attention to beefing up the rearmost part of the wing structure. Longer ailerons may also help.

### INBOARD AILERONS

Moving ailerons inboard by one quarter to a half of the wingtip chord tends to reduce aileron drag and yaw, but it hurts the low lift-coefficient roll rate and increases the servo load a little. When lowered at high lift coefficients, the portion of the aileron near the wingtip generates considerably more drag in relation to its lift than the part that's farther inboard.

### JUNKERS EXTERNAL AIRFOIL FLAPERON Weird but Effective!

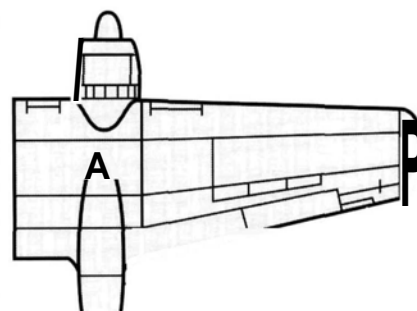
Landing flaps and ailerons can't usually occupy the same territory on the wing trailing edge. Designers are usually forced to bite the bullet and choose between maximum lift and strongest lateral control.

The odd-looking Junkers bi-wing flaperon (Figure 10) was one of the first practical cease-fires in the flap-versus-aileron turf battle. The sole survivor of many auxiliary airfoil schemes of the late 1920s and early 1930s, it may have been a sort of peace offering to biplane fanciers. It is a narrow, full-span auxiliary wing, positioned behind and below the wing's trailing edge. Lower it fully, and your reward is a large increase in lift that's roughly similar to that provided by a full-span single-slotted Fowler flap. Raise it about 5 degrees above neutral, and this unique

flaperon produces relatively low drag—particularly helpful when married to a wing with a draggy, highly cambered airfoil section. It has been used in various combinations of flap and aileron and as a one-piece flaperon. For best aerodynamic balance, the hinge axis is usually at about 20-percent chord behind its leading edge, although this complicates maintenance of the all-important flaperon/wing clearance. A mechanical stop should be used between flaperon and wing to prevent the excessive "down-" travel that may abruptly reduce lift—a particularly bad thing if it affects only one of the pair of flaperons.

Although its roots extend back to the late 1920s, some of today's STOL ultralights enjoy its hard to beat combination of simplicity and performance. The rakishly malevolent Junkers Ju 87 Stuka dive bomber is probably the most notorious example of its use. Used with a slotted wing, as on the Fieseler Storch, lift coeffi-

Figure 11.



*Northrop P-11 Black Widow wing. Small ailerons leave room for very long, powerful double-slotted flaps. Spoilers (just ahead of inboard slotted section) augmented lateral control. Spoiler lateral control was best at high angles of attack, where most ailerons develop heavy stall forces. It led the way to the superlateral yaw but complex arrangement used in curative liners.*

icients of up to 3.5 have been claimed. The tradeoffs are more drag and yaw than conventional flap/aileron setups, although scale enthusiasts report good results.

### LATERAL CONTROL SPOILERS Can they Replace Ailerons?

Spoilers are very effective lift killers and drag generators. Spoilers dedicated to lateral control are usually well back on the wing's upper surface where they can act more like ailerons. Lateral-control spoilers produce an effect that's more akin to that of an upside-down split flap than a conventional spoiler. Unlike ailerons, their advantage lies in their ability to produce rolling and yawing couples that act in the same direction, and they free up most, or even all, of the wing's trailing edge for large, powerful flaps.

Although poorly suited to aerobatics, they will work inverted—at least, at low lift coefficients. In inverted flight, their rolling and yawing couples oppose each other and produce horrible adverse yaw at high negative lift coefficients. (Forget low-speed inverted flight and tight outside turns.)

Apart from their increased drag, the downside of spoilers is similar to that of maximum aileron differential, i.e., "up" travel only—no "down." Raising a spoiler reduces the wing's lift without a compensating increase in lift of the opposite wing. The result is a loss of lift and a pitching down during roll that gives pilots a sinking feeling; example: Mitsubishi MU-2 executive turboprop twin; computer-controlled mixing could easily banish this problem in model use.

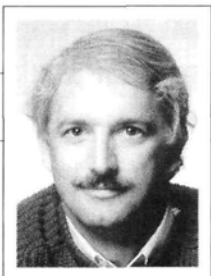
Smallish ailerons assisted by spoilers that operate when stronger control is needed provide more pilot-friendly control. The pace-setting Northrop P-61 Black Widow night fighter of WW II is an example (Figure II). Its long, double-slotted Fowler flaps gave this big, very fast bird relatively good short-field capability. Its lateral-control layout was years ahead of its time; today's big jets employ a roughly similar system. Despite swept wings that tend to worsen yaw/roll coupling, modern "heavies" achieve superbly pilot-friendly lateral control at a similarly hefty complexity toll.

In Part 2, I will delve into dihedral and tricks with vertical tail and fuselage lateral area that can boost controllability, stability and knife-edge aerobatics.

*"Addresses are listed alphabetically in the Index of Manufacturers on page 170.*



# AEROBATICS MADE EASY



DAVE PATRICK

## GAME FACE

"GAME FACE." I'm sure that those of you who follow sports have heard this expression before; but, for the benefit of those who haven't, it's the attitude or mental profile that competitors want to be in when playing a sport or competing in a game. I feel it can apply to many things in life, and particularly to when we fly a model airplane in competition. This month, I would like to touch upon something that has helped me to improve my flying and become more successful in competition: that is, the approach attitude.

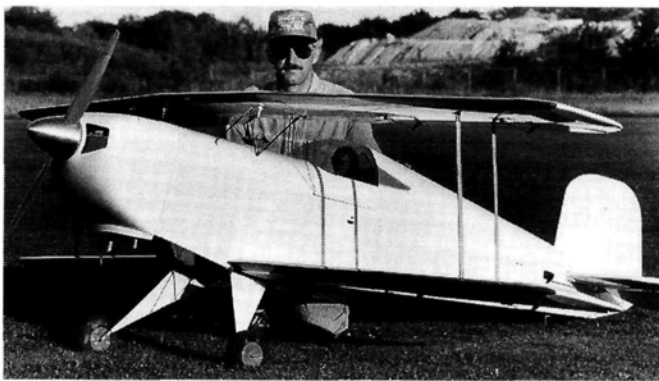
Years ago, when I decided that I wanted to compete, I really worked hard to win. I strived to win at nearly any cost. I would spend countless hours practicing and honing my skills and trying to find an edge. At contests, I would do fairly well, but winning top honors was rare and, at times, there was a lot of frustration because I had not come out on top.

After a few years of this, I decided that, as much as I loved to fly, this wasn't that much fun. I was nervous nearly every time I competed. Because of this self-imposed pressure, I often didn't seem to fly as well at a contest as I did at home. I finally decided to retire, and I sold my modeling gear. I didn't even miss it—for a couple of years.

I don't remember exactly how I got back into competitive flying, but there had been a fairly dramatic rule change that made me think. "Gee, this levels the playing field to some degree and may be a good opportunity for me to get back into the sport." I liked flying, but the competition aspect still didn't seem like that much fun. So I simply

decided to compete at local fun-fly contests that didn't have the pressure of the bigger events.

I decided to practice only when I felt like it. When I got rolling, it was four flights a day—max. Most important, at a competition, I focused on flying and not on who might beat me. I didn't look at scores but simply did my best and tried not to worry about it. This was much easier said than



*Author Dave Patrick is almost hidden behind the Bucker Jungman he built for the '94 TOC competition. In this column, he talks about how attitude can directly affect performance in competition as well as in practice.*

done, but it was to be my new "game face."

So off I went to a few events; and I started to win. Interestingly, after my self-imposed retirement, I was easily beating pilots who had stayed on the competition circuit and who had been beating me! I then went on to try bigger events and, slowly but surely, my success continued. In a way, I have never looked back.

Instead of being tense, I now try to relax. Once, at a world championship at Virginia Beach, I thought I would kick back and watch Hanno Prettnner put in a flight. I pulled out my Futaba transmitter case to use as a pillow, and in the ready box, I stretched out and watched. I was so relaxed, the next thing I knew, I was being awak-

ened because it was my turn to fly! As it turned out, I put in what I felt was a very good flight, and I was quite pleased with the score.

## SPORT FLYING

Great, but how does this apply to the sport flier? The concept of "game face" even applies to a person learning to fly. I can remember, as a beginner, being somewhat embarrassed about my skill level and feeling uncomfortable about demonstrating this lack of skill to the expert fliers at the field.

When I instruct, I tell my student to relax. "Nobody is watching; focus on the plane." I tell them that I won't let them crash (that may not always be true, but don't tell anyone!). Even the first-time flier can be intimidated when fellow fliers watch, and this can put undue pressure on the novice to succeed quickly.

Relax, focus on the airplane. It can be amazing how much faster a student can learn just by relaxing.

The sport flier doesn't need to aspire to be a competitor to benefit from putting on a game face. He can do it just to improve his flying skills. Sport flying with more control and with confidence is both safer and more fun. If you have a limited repertoire of maneuvers, great; but try to do those well. How many times have we heard a superstar discount a record that was broken and say, "That's not important to me; I just want to do my best." This is a gratifying sport, and it can be played at many levels.

Till next month. •



# Tailless Airplane Design *Part 3*

## *Control considerations for the five major tailless types*

by ANDY LENNON

**T**HIS ARTICLE DEALS with the details of the aerodynamic controls for the five types of tailless airplane (plain, swept-back, combined plain and swept-back, delta and swept-forward) discussed in Part 2 (May '95). Included are comments on weight distribution and static margin and a graphic method for locating the 1/4-chord mean aerodynamic center (MAC) and the MAC itself for multi-tapered wings.

### AILERONS AND ELEVONS

Adverse yaw is an important consideration when dealing with high-aspect-ratio (AR) wings of plain, swept-back or swept-forward configurations—particularly for ailerons or elevons located near or at the wingtips. On this author's designs, the modified frise aileron (see Figure 1A in "Roll Control Design," *Model Airplane News*, August '93) with heavy differential has been proven to provide roll control without adverse yaw. However, if they're used as elevons for elevator control, they

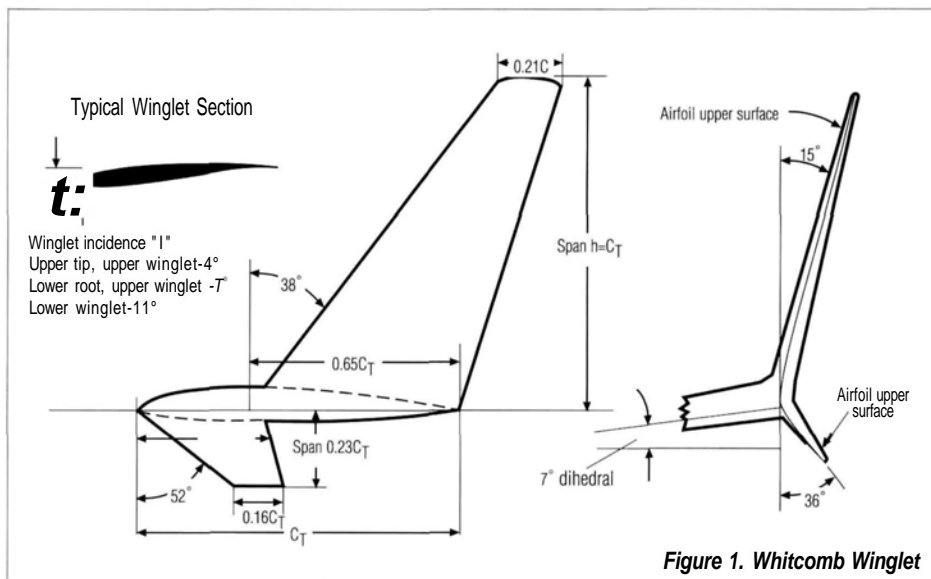


Figure 1. Whitcomb Winglet

should have equal up and down action. A two-servo arrangement, where the elevator servo moves the aileron servo back and forth, will provide the elevons with equal up and down action as elevators, and with differential action as ailerons.

On plain or delta wings of low AR, the

need for anti-yaw differential is greatly reduced. On swept-forward wings (without high-lift devices), modified frise ailerons located at the wingtips and with anti-yaw differential are suggested. Elevators are then located at the inboard trailing edges where their moment arm from the CG is

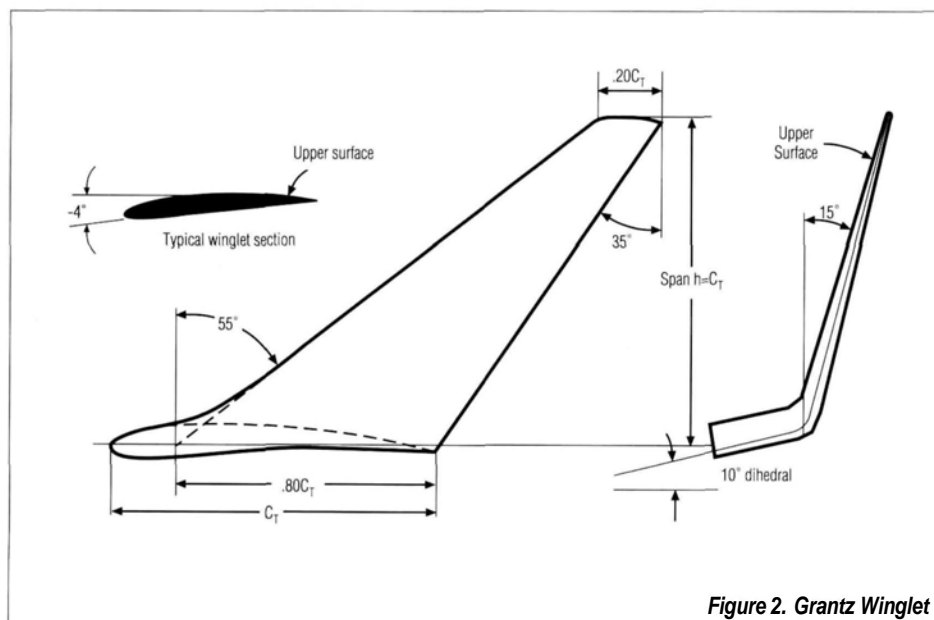


Figure 2. Grantz Winglet

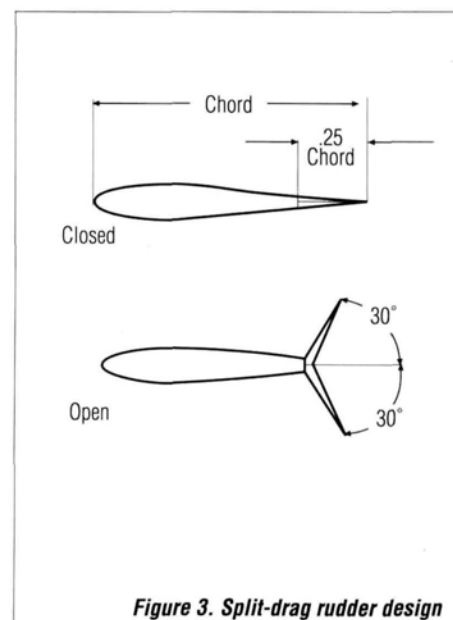


Figure 3. Split-drag rudder design



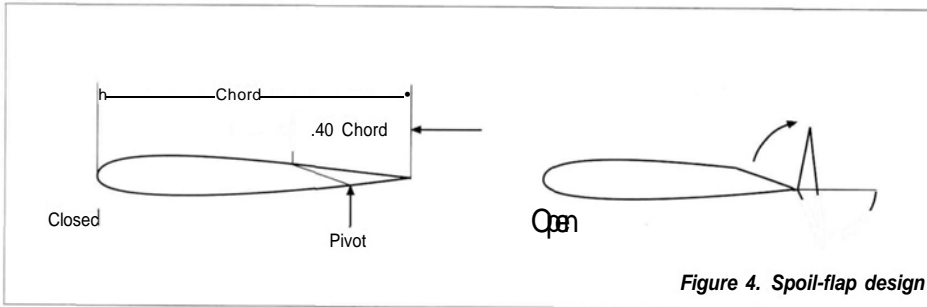


Figure 4. Spoil-flap design

the greatest.

For swept-forward wings with inboard, high-lift devices, slotted elevators/elevons (similar to the slotted flap shown in "Design for Flaps, Part 2," *Model Airplane News*, November '91) are suggested. These provide additional lift to balance that of the high-lift devices.

It's suggested that elevators that are separate from ailerons be used where possible. The top-hinged variety (see Figure IC in "Roll Control Design," *Model Airplane News*, August '93) with equal up/down action is suggested.

## VERTICAL SURFACES

For plain, delta and swept-forward tailless planforms, a single vertical surface on the center line is optimum. Placing the rudder-hinge line at or behind the wing trailing edge provides a healthy moment arm. Positioning 1/4 to 1/3 of the vertical tail area below the wing will improve its effectiveness at wing high angles of attack where

the above-wing portion may be blanketed by the wing's turbulence. The anhedral and swept-back outer panels of the combined plain and swept-back tailless configuration present side areas that act as vertical surfaces. (The vertical tail area is described in "Vertical Tail Design," *Model*

*Airplane News*, January '94 and "Spiral Stability Design," *Model Airplane News*, July '94.)

Note that the sideways-projected areas are proportional to the angle at which these outer panels are anhedral; and their plan-view area is inversely proportional to this angle.

On swept-back tailless wings, the location that provides the greatest vertical tail-moment arm is at the wingtips (control surfaces with greater moment arms need less area for equal effectiveness). If symmetrical airfoil sections are used in the dual-wingtip vertical surfaces, "toeing-in" their

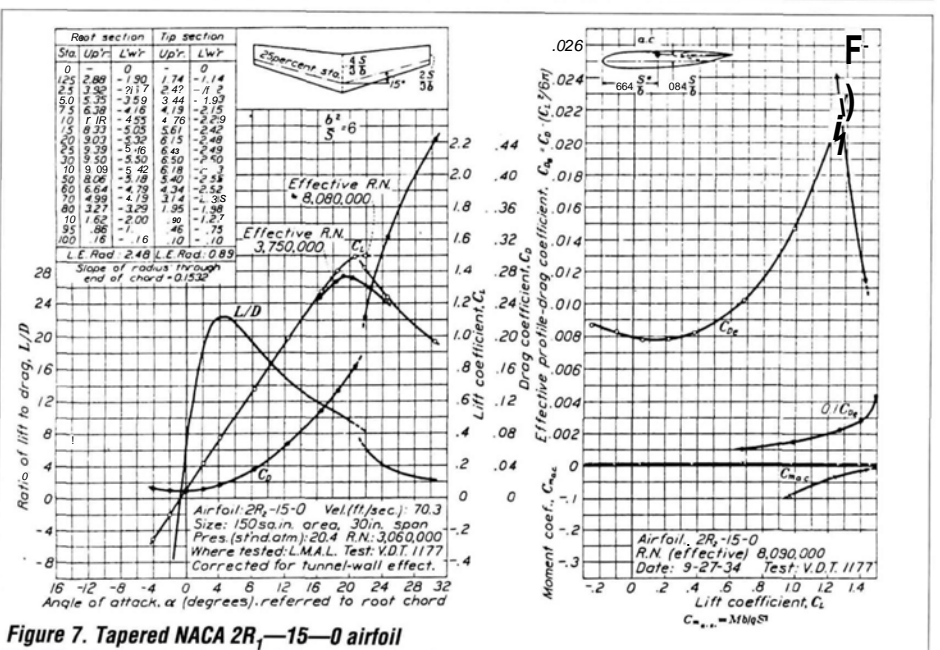
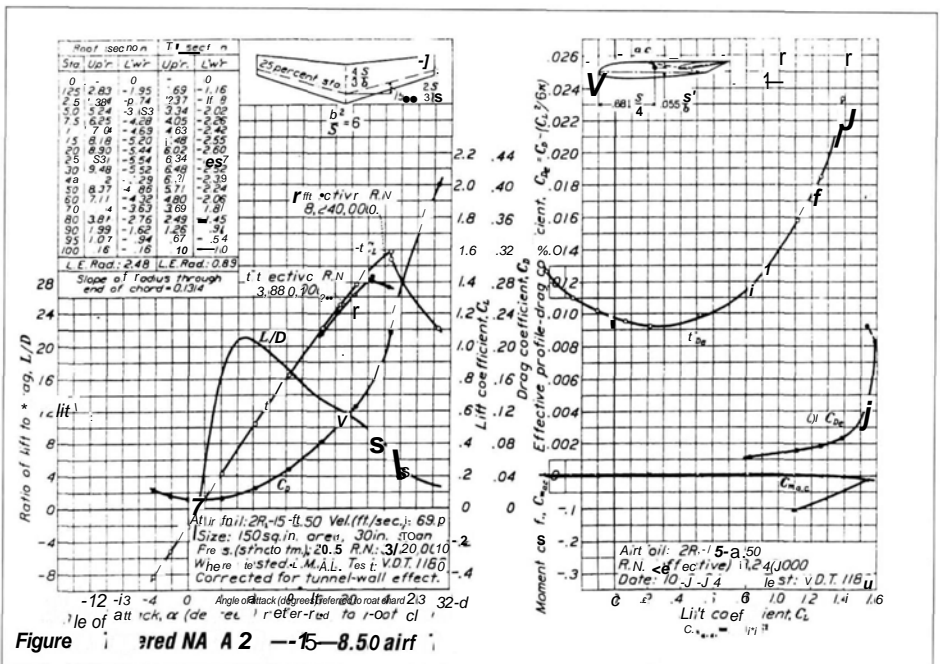


Figure 6. Tapered NACA 2R<sub>1</sub>-15-0 airfoil

Figure 7. Fixed leading-edge slot at Rn 600,000



chord lines' by 2 or 3 degrees is suggested.

Two forms of winglets—the Whitcomb and the Grantz—may be used as wingtip vertical surfaces (see Figures 1 and 2). The dimensions of both are related to the wingtip chord and will provide vertical areas that may or may not be adequate. Determine the areas needed and, maintaining the same proportions, size the winglets to the desired area. Rudder area should be 30 percent of the area of any of the vertical surfaces discussed. On swept-forward wings, because of the directional instability of this planform, large central vertical surfaces are mandatory.

This author's Plover glider (see Figure 7 in "Tailless Airplane Design, Part 1," *Model Airplane News*, April '95) had a vertical tail-moment arm of twice the wing's MAC and an area 10 percent of the wing's. A large vertical surface could result in spiral instability.

## SPLIT-DRAG RUDDERS AND SPOILERS

Northrop and Davis flying wings employed split-drag rudders at the wingtips as in Figure 3. Opened on one wing panel, the added drag acted like rudders. Engel's "Winglet" (*Model Airplane News* plan no. FSP03941) also has split-drag rudders.

Spoilers may be used for both glide control and directional control, but they may also replace ailerons for roll control when used on the wing's upper surface only.

Placing the spoiler's leading edge beyond 70 percent of the wing chord

avoids the lag between control action and response, which is characteristic of spoilers located farther forward on the wing chord.

Spoilers create desirable into-the-turn yaw, because only the spoiler on the inside of the turn is raised; its mate remains flush with the wing. ("Roll Control Design," *Model Airplane News*, August '93, provides more information.)

The Hortens used spoilers on both upper and lower wingtip surfaces for directional control. When not in use, both split-drag rudders and spoilers lie flush with the wing surface and cause no drag.

## SPOIL FLAPS

Spoil flaps are shown in Figure 4. They were used on this author's "Dove"—a

powered glider featured in *Model Airplane News*, November '94. The spoil flaps were used for glide control and proved to be successful. Their combined areas were 7 percent of the Dove's wing area. Extended, they didn't change the Dove's in-flight attitude, but they did cause a greater sink rate. They were used for slow, steep descents from height and for short, no-float landings. Used separately, they could act as drag rudders.

## LEADING-EDGE FIXED SLOTS

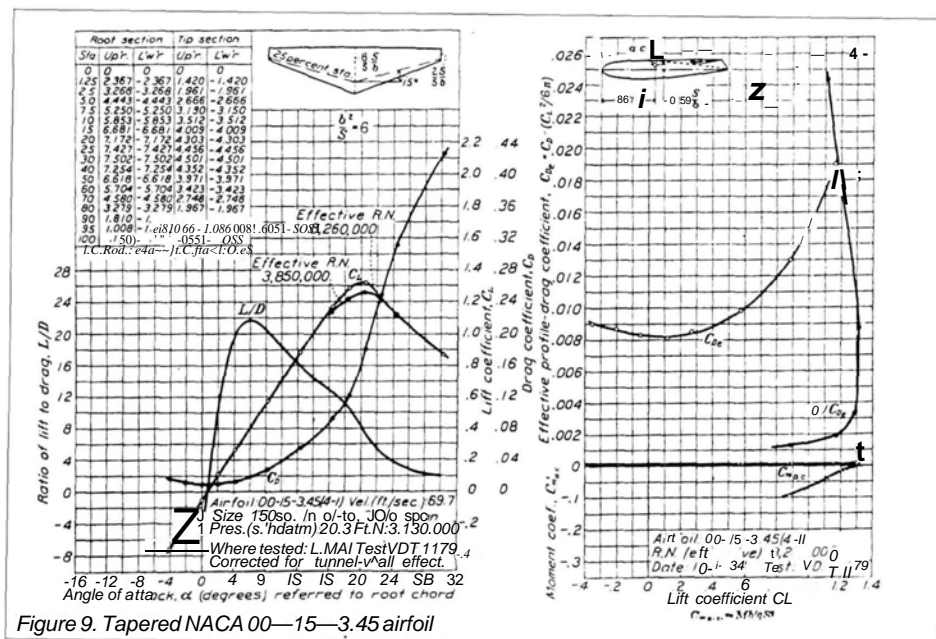
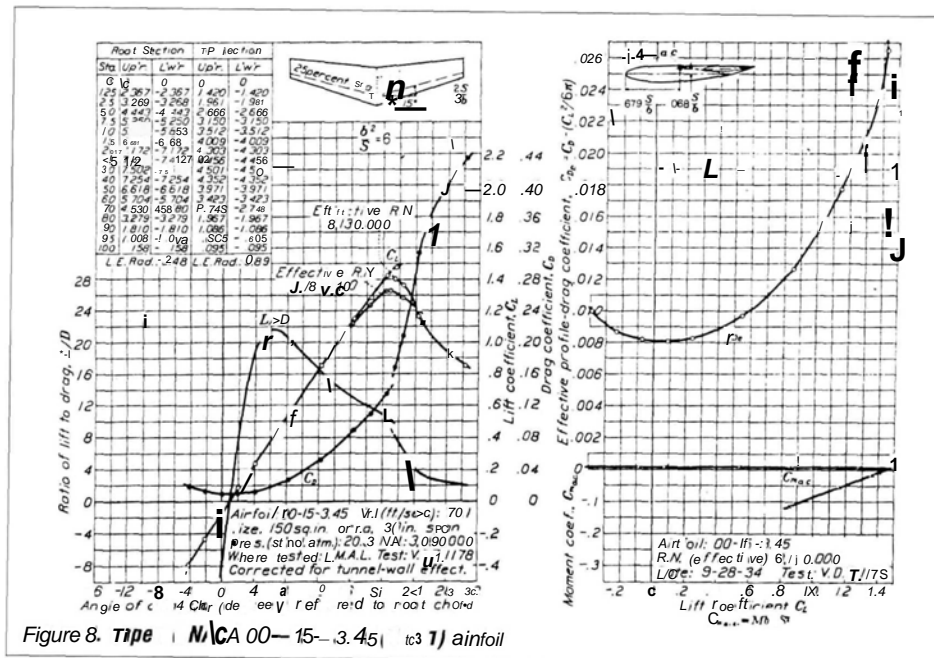
Despite washout, swept-back, highly tapered wings are prone to tip-stalling at high angles of attack. This results in loss of longitudinal control. Fixed leading-edge slots, as shown in Figure 5, delay the stall about 9 degrees and increase the maximum lift coefficient substantially, but have very low drag. Both Northrop and Davis used them at the wingtips, extending for 25 percent of the wing's semi-span.

The basic dimensions for the slot shown in Figure 5 may be applied to any airfoil section.

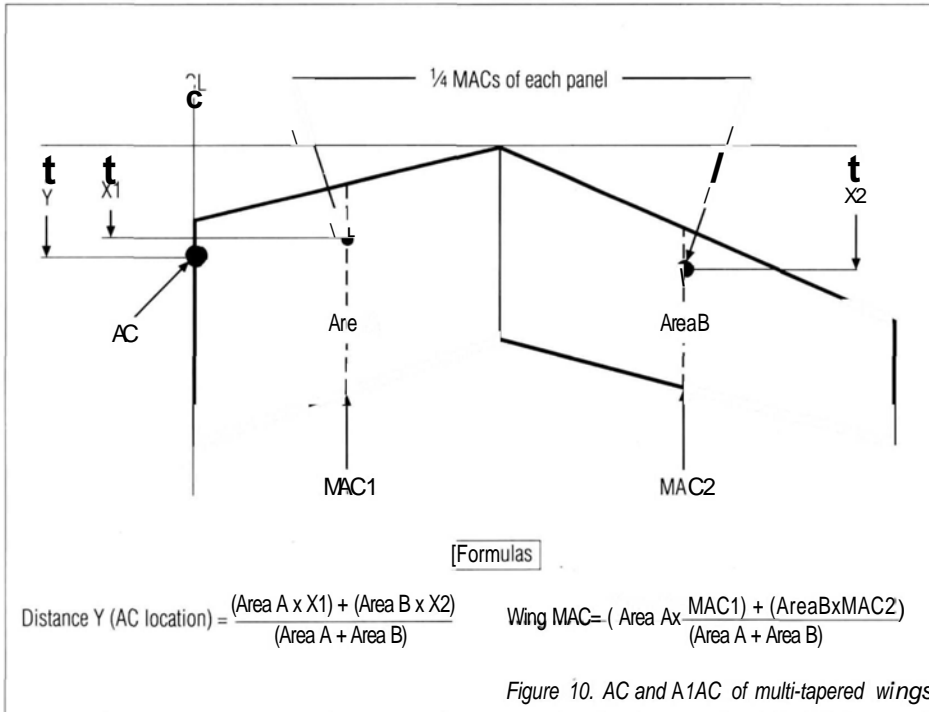
## WASHOUT AND SWEEPBACK

Figures 6, 7, 8 and 9 reflect wind-tunnel tests performed by NACA on four different wings. All were stable at the stall (pitching moment becomes negative). The wing shown in Figure 6 has a reflexed airfoil and 8.5 degrees of washout. The wing in Figure 7 also has a reflexed airfoil but no washout. The wings shown in Figures 8 and 9 have 3.45 degrees of washout.

In Figures 6, 7 and 8, the taper ratios are 2 to 1 from root to tip. In Figure 9, the wing's 4-to-1 taper invited early tip-stall,







along with reduced maximum lift coefficient (CL max). These figures provide root and tip airfoil ordinates and aerodynamic center location. "S" is wing area and "b" is span. Although tested at high Reynolds numbers, these wings are a useful guide for swept-back designs.

### DIHEDRAL

Swept-back and delta wings need no dihedral. The plain and swept-forward types should have the dihedral angles that are suggested in "Spiral Stability Design," *Model Airplane News*, July '94. Combined plain and swept-back wings need a healthy amount of dihedral in the plain section to compensate for the anhedral tips.

### STATIC MARGIN

As explained in Part 1, the aerodynamic center (AC) and neutral point (NP) of tailless airplanes coincide. For stability, the CG must be ahead of the AC/NP. This produces a "force couple"—lift upward and CG downward—that must be balanced by a rear download.

The larger the static margin (the distance between the CG and AC/NP), the greater the aft download necessary. Centrifugal force created during maneuvers requires an increase in all three: lift, weight at the CG and balancing force.

Large static margins, however, are more stable longitudinally; small margins promote maneuverability, but reduce stability. A safety margin (SM) of 5 to 10 percent of the wing's MAC is suggested.

The swept-forward wing obtains equi-

librium by increased lift created toward its tips. This permits the use of cambered, high-CL-max airfoils, healthy stability margins and high-lift devices.

### WEIGHT DISTRIBUTION

This is important, longitudinally, for tailless airplanes, because of their limited longitudinal control when compared with "tailed" airplanes ("Weight Distribution in Design," *Model Airplane News*, October '94). Massing the fixed weights of power and control units as close to the CG as possible is recommended for tailless designs. Positioning the fuel tank on the model's CG will avoid a possibly destabilizing shift of the CG as fuel is consumed and the tank becomes lighter.

### LOCATING THE AC AND MAC

In "Airfoil Selection, Part 3" (*Model Airplane News*, June '92), graphic methods for locating the AC and MAC of straight, tapered and swept-back wings are explained.

For multi-tapered wings—such as the one shown in Figure 10—obtain the 1/4 MACs of each panel (A and B) using the methods shown in the aforementioned article. Calculate the area of each panel (in square inches) and, using the simple formulas that accompany Figure 10, obtain the wing's AC and its MAC.

This author hopes that this design series has proven both informative and useful in the design of innovative, good flying model aircraft.

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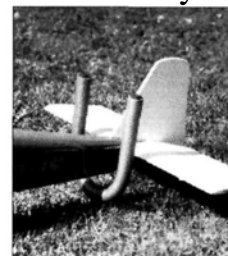


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# CENTER ON LIFT



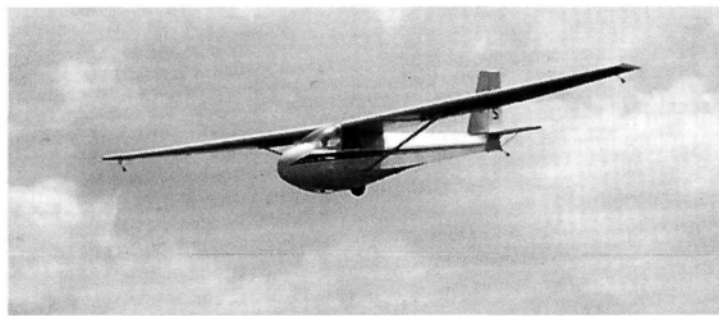
M I C H A E L L A C H O W S K I

## FINDING THERMALS IN HUMID CONDITIONS

THIS MONTH, I'll continue my discussion of thermals and focus on moisture and humidity. Anyone who flies in humid conditions probably recognizes that the thermals I described in my last column (those caused by direct solar heating of the ground) are different from what is normally encountered. Another topic I always come back to is improving the control system in the glider; this time, it's solid-wire pushrods in larger models. Finally, there are some major events coming up, and I've made a call for support for our U.S. F3B Soaring Team.

### THERMALS, MOISTURE AND HUMIDITY

In my last column, I talked about warm air being lighter air, but another factor can make air lighter: air that contains water vapor is lighter than dry air.



*An SGS 2-33A on approach. It's a really modern glider compared with some that will be at the upcoming International Vintage Sailplane meet.*

PHOTO BY MICHAEL LACHOWSKI

Combining water vapor and warmer air provides just what we need for a thermal.

Water vapor gets into the air in several ways. One is by evaporation from moist ground. Unfortunately, evaporation requires a great deal of heat, so the actual temperature of the rising air in humid conditions is much lower than the temperature of dry air. Moisture in the air conducts heat away from the thermal and spreads it out, reducing the thermal's strength. I also mentioned that air is a poor conductor of heat, but water is an excellent conductor. That's why you put a vapor barrier in a house to protect the insulation from moisture.

Now you can start to understand why thermals on humid days are weak and fuzzy as opposed to the nice, well-defined "ideal thermals" that you're likely to find on dry days. The dust devils you get on humid days are really big (some folks

call them tornadoes!).

Plants are a wonderful source of moisture. Trees put tons of water into the air each day. Different kinds of trees put different amounts of moisture into the air; they also heat up at different rates. If you must pick a forested area in which to search for thermals, pick evergreen trees over deciduous ones. Evergreen trees put less water into the air and the air heats better.

The nicest part about water vapor is that it scatters light and turns a blue sky white. Now you know why some people can just look up and see thermals some days. They're looking at hazy areas in the sky that are caused by moist air. Most of the time, this air is rising; it might not be rising rapidly, but it's more than enough to keep a plane aloft. If you're used to dry weather, take a trip out to the Midwest in late summer. These conditions are quite common there at that time.

### THERMALS CAUSED BY MOISTURE DIFFERENCES

The last place you might think to look for a thermal is at a lake or a swamp. Surprise!; a difference in humidity can actually create thermals there, even if the temperature over the area is lower than that of the surrounding area. At the '93 Tangerine, the swamp behind the landing area was often the source of a very light lift. The extra moisture was just enough to keep the planes aloft.



*Evergreen forests produce better thermals than deciduous ones. Less water evaporates from the evergreen trees, so the thermals are better.*





*A Pratt Read G-1 being prepared for flight at Harris Hill at the Vintage Sailplane Association meet.*

Sometimes the lift would break away but, generally, it dissipated downwind.

If you fly where it's cold and a nearby pond or lake is warm enough, the combination of warmth and moisture is a good source for thermals.

By now, you're starting to make a list of all these different thermal sources. No one source, however, is guaranteed to work. Many of these situations depend on specific weather conditions: dry air, moist air, temperature, winds, terrain and time of year. There's no substitute for practice and experience.

### WORKING A LIGHT, HUMID LIFT

The biggest mistake that's made when flying in a light, humid lift is failing to remember Dave Thornburg's wonderful analogy of, "the river of air," which implies that the air moves downwind. The effects of this "river of air" can be seen when an inexperienced flier, thrilled that his model is hanging in there so well just upwind of the launch, can't keep his plane in the air long enough to make a "max" because a bad stream of air has floated into the plane's space. To avoid that problem, you need to make a nice, careful circle, and drift downwind with the good stream of air. You probably don't need a tight circle; a really good pilot can look as though he's just flying around, not even working the lift. Just keep track of everyone upwind so you know where the lift ends.

### SOLID-WIRE PUSHRODS

Cables seem to be the most popular pushrod technique for tail surfaces on sailplanes. They work well, but solid-wire pushrods work even better and have

less play and flexibility outside the sheath.

Although poor cable installations can still work adequately, poor installation of solid-wire

pushrods can result in excessive binding. The key to effectively installing either kind of pushrod is to make sure the sheath the pushrod runs through is as straight as possible. To keep it straight, install the sheath with the wire already inside. You might find this technique helpful even if you continue to use cable. Put a piece of solid wire inside the sheath while you glue it to the fuselage.

Solid wire may have a very slight weight penalty. If you really want to avoid the excess weight, you can substitute carbon fiber for the wire. The pilot who spends as much time repairing as he does flying, however, should avoid the carbon-fiber or straight-wire pushrods. Carbon-fiber rods will break in a crash, and wire pushrods that are bent in a crash will have to be carefully straightened.

What should you use? There's no one answer; but it's fun to experiment.

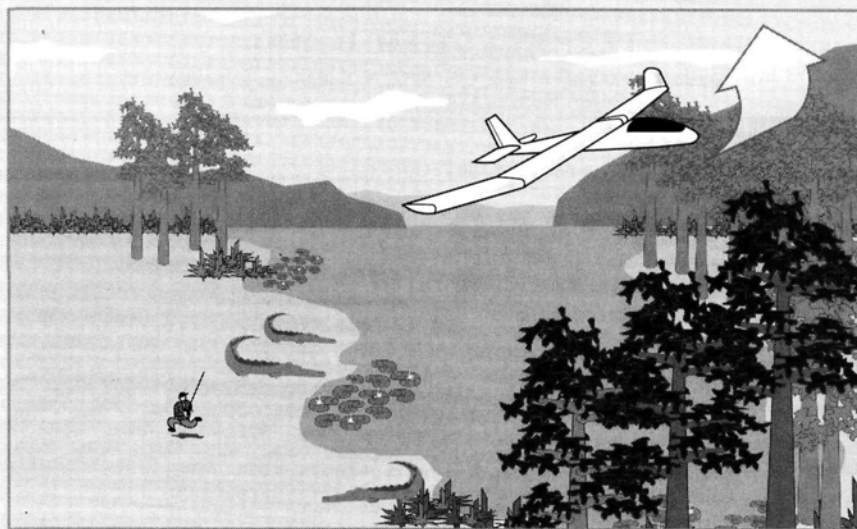
### U.S. FSB TEAM SUPPORT

Help support the 1995 U.S. F3B Team in its quest for gold. Our very capable team pilots are Joe Wurts, Daryl Perkins and Randy Spencer. They'll travel to Romania in July along with team manager Larry Jolly and team helpers Tim Renaud and Dwayne Lane.

You can support them by purchasing team merchandise that's decorated with a really slick logo. Items include: T-shirts (medium, large and X-large for \$15 and XX-large for \$16); pins for \$3; patches for \$5; and stickers for \$3. Don't forget to add 10 percent for shipping. Send your order to U.S. F3B Soaring Team, 15781 Empire Ln., Westminster, CA 92683; (714)839-4166.

### LSF NATS

The 1995 LSF/AMA Nationals are shaping up for the week of July 29 to August 6. This year, the multi-site event will return to Muncie, IN—home of the AMA. There will be the traditional LSF



*Humidity from a swampy area can be a source of lift; just don't land there!*



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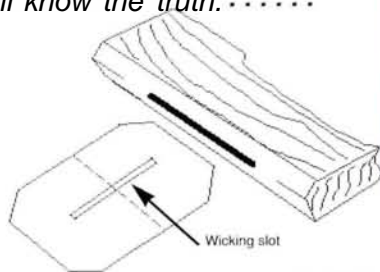
Add the other half of the control surface being hinged.

Repeat the adhesive procedure.

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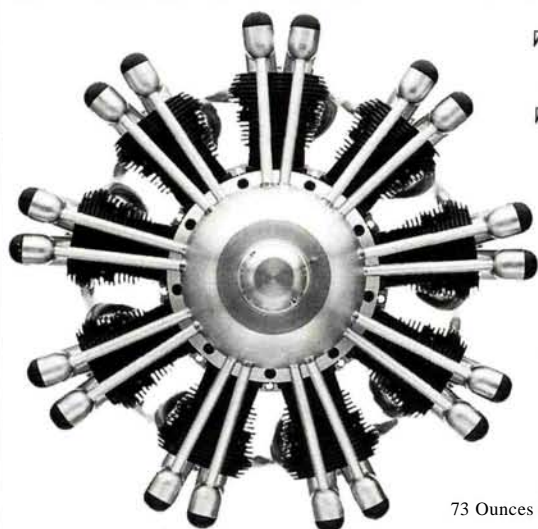
## CENTER ON LIFT

man-on-man thermal soaring and two days each for flying 2-Meter and Unlimited. There will be plenty of rounds in two days of flying for the main thermal events. This really is a national championship. Several one-day events are on the calendar, too, including hand launch, F3B and F3J events. If you didn't attend last year and want an event calendar and an entry application, send an SASE to Mike Stump, 607 Washington St., Cadillac, MI 49601.

## INTERNATIONAL VINTAGE SAILPLANE MEET

The International Vintage Sailplane Meet will be held at historic Harris Hill in Elmira, NY, on July 16 to 25. This is the first time that this international full-scale soaring event will be held in the U.S., and it's the first international soaring event since before WW II to be held on Harris Hill! It should be a real treat for anyone who's interested in scale sailplanes.

The meet has attracted a number of international entries and a variety of rare, vintage gliders. Among the 10 European, two Canadian and 36 American vintage sailplanes scheduled to attend are: a DFS Kranich II, a Minimoa, a King Kite and a Fauvel AV-22. You can also see the Baker-McMillen "Cadet"—the oldest flying glider in the world. You can visit the National Soaring Museum (51 Soaring Hill Dr., Harris Hill, Elmira, NY 14903; [607] 734-3128) and see even more soaring history. I've attended some vintage sailplane regattas before, and to see these vintage and classic full-scale sailplanes in flight is a thrill. If you're interested in vintage or classic sailplanes and gliders, you should join the Vintage Sailplane Association (Rt. 1, Box 239, Lovettsville, VA 22080; \$15 annual dues); their newsletter, *Bungee Cord*, is always full of useful information.



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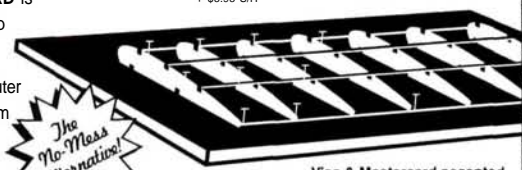
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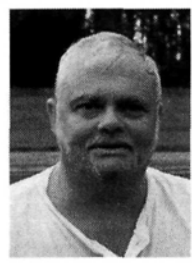
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# SPORTY SCALE



FRANK TIANO

## A GATHERING OF EAGLES

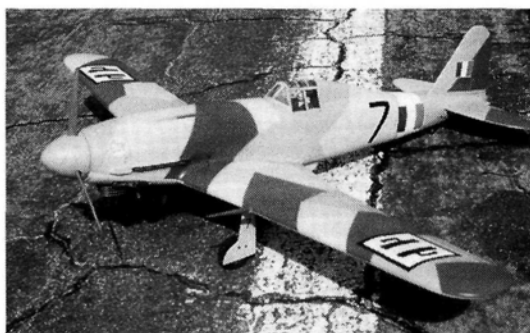
EACH YEAR, an event takes place around the last week of October that I truly think each of you would enjoy attending or at least reading about. I'm speaking of the Rally of Eagles that's hosted by Jack Dorman and company at the closed Navy airfield in Navarre, FL. Now, before you go off thinking that Florida is a long distance away, remember that Navarre is in the far western part of the state, near Alabama, just a few hours from most places in the Midwest and less than a day's drive from most others.

### A GATHERING OF EAGLES

The Rally was created so that any scale modeler and any worthy scale model could fly in a relaxed atmosphere. It usually attracts a host of competition pilots from various parts of the country because the season is over for them, and this provides a choice place to unveil a new ship or refine a current one. This is open flying at its best—no pressure, just lots of fun. What sets it apart from a normal fun-fly is that the Rally folks have one strict rule: no dogs allowed! In other words, don't even think about taking an Ugly Stick, or an ugly P-51, for that matter! Nope, this weekend is for good-looking scale models that everyone can enjoy.



Steve Payne kept busy all weekend; he brought three warbirds to the Rally. Here's his Byron Originals P-51 with a prop drive and a 4-blade prop. Steve almost had the low-pass award, but yours truly beat him by a prop blade!



Designed and built by Paul Byron, this Fiat G-55 impressed everyone at the Rally with its rock-stable, low flybys and great aerobatic demonstrations. It's approximately 80 inches in span, and it's powered by a Quadra\* 40.



This beautiful T-6 was built from Jerry Bates Plans\* by the Rally's CD, Jack Dorman. Jack also makes great cockpit kits.

### INNOVATIVE PROJECTS

This year, we were treated to several innovative subjects. For example, we got a close-up look at Steve Payne's new 80-inch Focke-Wulf from Bob Holman Plans\* and Bob's new scale landing gear. That's right, this gear has the correct angles that are so hard to achieve on the FW-190, and its design allows correct placement of the gear units as well. Even the horizontal brace, which is so prominent in the front view, is in place, and it retracts along with the gear legs in a very scale-like manner. Steve

uses an O.S.\* twin-cylinder engine for power, and the performance and sound are outstanding.

For the first time, the Rally had an overabundance of Byron Originals\* kits in attendance. And every one of these airplanes was finished in a very professional manner. It just shows that an airplane doesn't have to be exact scale to look great and perform well.

Another trouble-free group of models was the jet fleet brought in by the bandits from Bob Violet Models\*. There were no less than 10 scale jets this year, and every one of them flew flawlessly. We were especially impressed by BVM's new F-4 that demonstrated a flight envelope that had to be seen to be believed! Surprisingly, this was the first Rally that was literally inundated with warbirds. I don't think any more than 25 percent of the entries were civilian airplanes. The year before, the balance was about equal.

### MANY FIRSTS

We saw our very first Midwest\* T-6 fly and, boy, did it fly well. This one had an O.S. 1.08 for power, and it really tore up the sky. I couldn't help but notice that this T-6, as well as other brands I've seen fly, really needs flaps to land properly—by properly. I mean a no-bounce landing



Hal Ware showed off his Hurricane, which was done in a very attractive color scheme. The Quadra-powered bird flew all weekend and proudly displayed Warpaints Ltd. colors.



## SPORTY SCALE



Another Byro-plane: John Stare's magnificent Beech Staggerwing. This model weighs just 24 pounds and flies perfectly with a Quadra 42. It's a stock kit all the way, once again showing that Byron has some good stuff to offer.

as opposed to several short hops that usually result in at least a scuffed wingtip or two. We've noticed comparable traits in the Zirolì, Byron, Bridi and even the smaller Top Flite T-6s as well, so an educated guess is that the design needs flaps to settle in effectively.

We also witnessed another first at the Rally. I think that this event has



Pat McCurry fielded one of the hottest-looking Messerschmitts you're ever gonna see. This Platt kit was taken to the nth degree with scale flaps, hatches everywhere and a modified Galland hood (that's a late-model canopy to you new guys). Only 16 pounds and powered by an O.S. 1.08, it handled crosswinds extremely well.



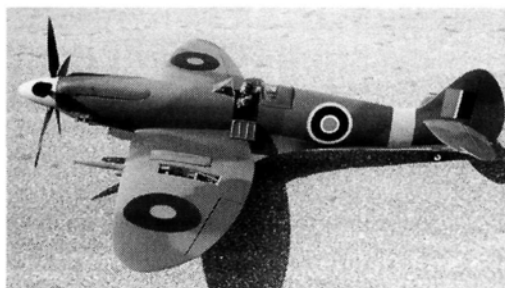
Wayne Knight took a wrecked Zirolì C-47 and turned it into a real attention-getter. He traveled from Boca Raton, FL, and flew the daylight out of this bird. It uses a pair of O.S. 1.08s for reliability in the highest degree. Low passes are a real thrill to watch.

set the world's record for the number of WW II airplanes in the air at the same time. One "gaggle" had no less than 11 fighters and Wayne Knight's huge C-47. The crowd went nuts during this spectacle, cheering wildly and snapping hundreds of pictures. Unfortunately, I was flying as well, so I don't have a single picture to share with you guys. Sorry!

Why have I gone on about the Rally of Eagles? Good question, and the answer is good, too. I think that similar events should be hosted all over the country. What better way to get a group of scale modelers together? Yes, I know that there are lots and lots of IMAA events to choose from, but those events are for sport model flying and aren't exclusively scale. A Rally allows scale models, period!—no matter what size, just as long as they're nice. So far, I'm aware of only three clubs that host similar functions: the Vssh Air Force, the California Scale Squadron and, of course, the infamous F-Troop. So why not host your own Rally of Eagles? I bet the participation will be overwhelming!

### WAR PAINT

OK, I'm gonna make this short and sweet because I don't want anybody to think I'm favoring the Heavy Metal boys and pushing the Piper Cub, Waco and Beechcraft guys aside. Warpaints Ltd.\* offers just about any WW II color you can think of in pints, quarts, or gallons. That's right: accurate finishes that are already mixed for you. Colors are formulated in lacquer, and they match either a published Federal Standard (FS) chip or the FTE/M&M color-guide chips. Prices are: \$3/pint, \$5/quart and \$18/gallon. And



Phil Sibilie came down from Maryland with his not-quite-finished Dave Platt Models Spitfire. Phil likes to show off things such as open hatches and machine-gun bays in the wing and stuff. Panel lines and rivets will come later; the markings were put in place temporarily for the Rally!

they have primer, thinner and plasticizers available. For some of you, your problems have just been solved.

Well, that's it for another month. Don't forget that Top Gun is happening the last weekend in April, and, as usual, *Model Airplane News* will be there in force. There are lots of new



Mike Kulczyk's beautiful F-84 spans more than 80 inches and weighs almost 20 pounds, and the BVM 91 and Viojet haul it around at a pretty good clip. Mike brought it all the way from West Texas!

guys and models for 1995, and I'm especially pleased to announce that there are 10 foreign entries. We're looking forward to another turbine-powered model, the return of the Skip Mast's C-130 Hercules and a brand-new, larger-than-before Dave Platt Mohawk. If you're planning to attend, please stop by and introduce yourself to me or the *Model Airplane News* staff. We always find it a pleasure to meet with you. After all, without you guys, there would be no Top Gun or *Model Airplane News*. Your six is definitely clear.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 170. 1



# HOW TO

# Design a Streamlined Cowl

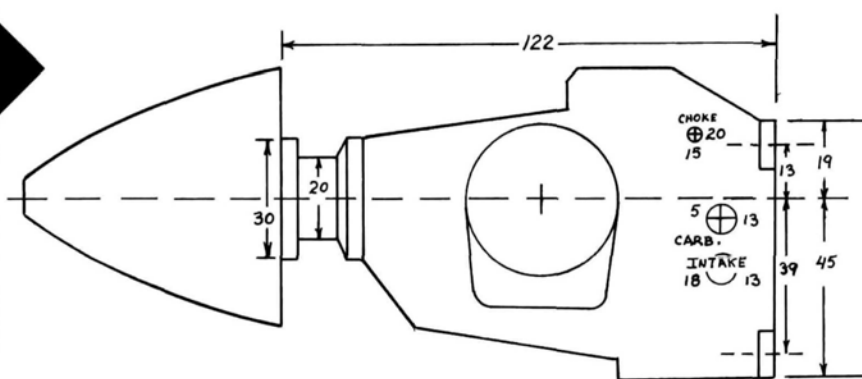
by FAYE STILLEY

Streamlined cowls greatly enhance the appearance of any aircraft. They can even

make an otherwise boxy sport plane look very scale-like. Cowls can be made out of many materials: wood, fiberglass, vacuum-formed plastic, etc. I'll focus on building a cowl out of balsa using tools that are usually found in the hobby workshop.

There are two techniques for building a cowl out of balsa: a block of balsa can be carved and hollowed out, or the cowl can be built up out of sheet balsa. The carving method takes a great deal of time and requires large blocks of balsa, which are very expensive. The built-up method is explained here; it produces a light, inexpensive cowl and is a lot less work. Building the cowl shown here is more complicated than building most other cowls. I chose this type because it enables me to show many techniques, some of which you may never use, but they're here if you need them.

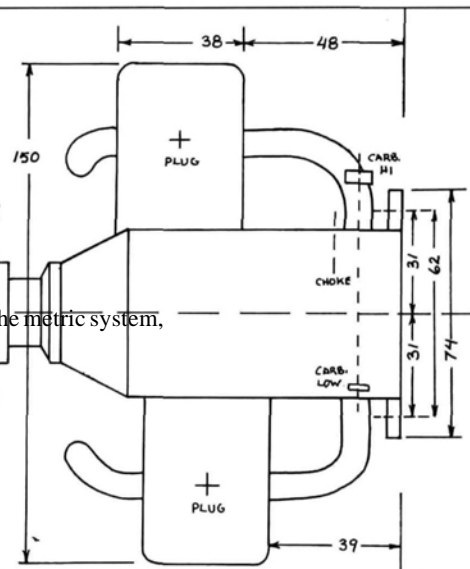
1



Before you begin, you must consider the size of your engine and spinner and the locations of the engine controls and the mounting bolts. First, make a side-view drawing of the engine and the spinner. Artistic ability isn't important, but accurate measurements are. Measurements that relate to the size of the cowl, both externally and internally, should be taken. I use metric measurements (mm) for these particular dimensions because most engines are in metric sizes.

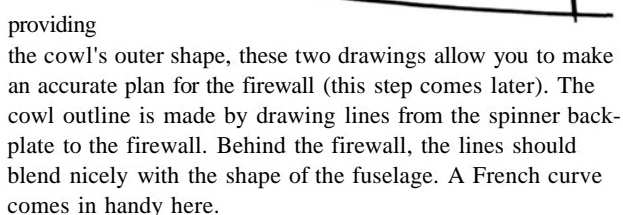
2

Using metric measurements, make a top-view drawing of the engine and the spinner. Because this is a twin-cylinder engine with offset cylinders, the job is a little more difficult than it would be with a single-cylinder engine. You may never build a cowl quite like this one, but the techniques described here apply to all streamlined-cowl designs. I'll lay out the wooden parts in inches because wood is soft, and it's difficult to accurately cut in increments of less than 1/16 inch. If you prefer the metric system, however, go ahead and use it. Measuring and drawing this engine "template" may seem like a lot of bother, but later, you'll be very glad that you took the time to do it. Also, if your engine outlasts your airplane, you'll have the engine template for the next airplane.

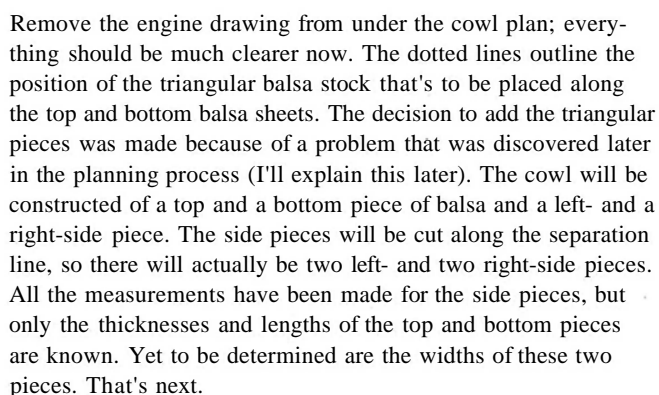




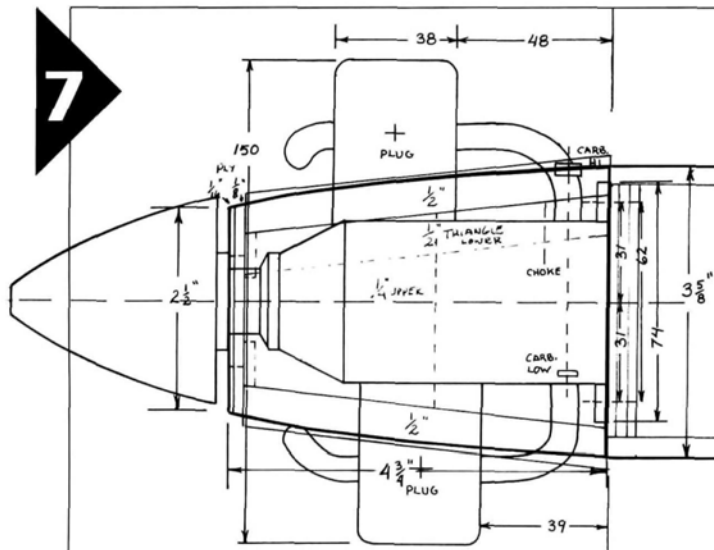
The plans for this particular airplane call for downthrust in the engine; the firewall is positioned so that the engine can provide the necessary downthrust. In the drawing, the engine center line meets the aircraft thrust line at the center of the spinner backplate. The engine drawing has the mounting-bolt locations, which, when transferred to the firewall, place the engine thrust line in the proper position. In addition to



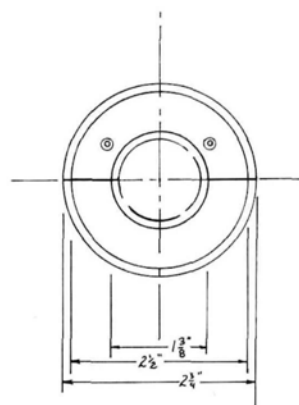
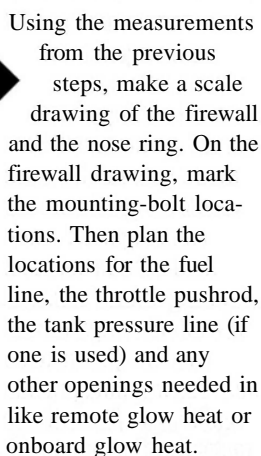
After the cowl outline has been completed, the plan for the wooden parts can be made. The cowl has a nose ring that's made out of 1/16- and 1/8-inch-thick pieces of plywood that are laminated together. This is attached to an 1/8-inch-thick-plywood backplate. In the drawing, the top and bottom balsa sheets are thick enough to allow the desired curvature and to provide an adequate overlap where the wood will meet the nose ring and the fire-wall. The curved, dotted line' just above the engine indicates that a small amount of wood will have to be removed from the inside of the cowl to provide clearance for the engine. Now is the time to decide where the cowl halves will be separated. In this case, I followed the thrust line of the airplane (an arbitrary decision). The separation can be made anywhere as long as the top half of the cowl can be removed without being obstructed by the engine.



Several observations can be made at this stage of planning. The plugs will be outside the cowl and will be accessible. The exhaust pipes will also be outside the cowl, so they won't interfere with the cool air that's entering the carburetor. The intake pipes enter the cylinders from outside the cowl but exit from inside. All the engine-adjustment controls—the high-speed needle valve, the low-speed needle valve and the choke—must end up inside the cowl. Access holes will have to be provided. We know from the top and side-view engine drawings exactly where these controls are, so we can proceed with confidence, fully aware of these design considerations.



This is the plan for the top and bottom balsa pieces. It also shows the clearance that's needed in the center of the nose ring for the engine's drive flange. There's one more, very important step that must be taken before cutting the wood. I mentioned earlier that a problem with the cowl design became obvious in a later step. If the next step isn't taken, some serious—perhaps irreparable—damage might occur while shaping the cowl.



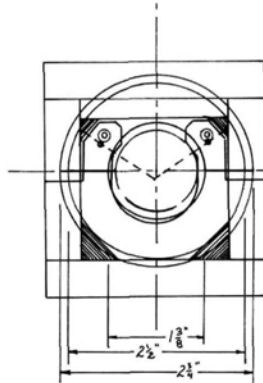
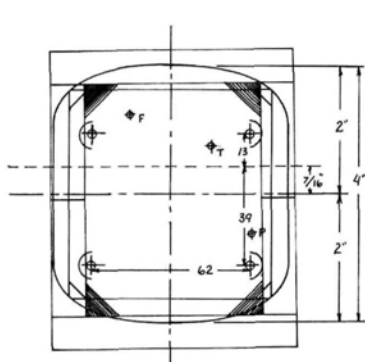
2 3/4 inches—a full 1/4 inch larger than in the front. Draw both dimensions on the plan. The diameter of the inner hole is  $V_x$  inch larger than the drive flange on the engine shaft.

One new measurement is required. The nose ring is 3/16 inch thick. In this particular case, the diameter of the spinner backplate is 2 1/2 inches. It would be easy to make the mistake of cutting the nose ring to 2 1/2 inches in diameter. The nose ring, however, tapers out along the curvature of the cowl. When the rear of the nose ring was measured on the drawing, it was



10

With tracing paper taped over the firewall and nose-ring plan, transfer the measurements and draw the wood plan (outline for cutting the balsa). After I had drawn the firewall and nose-ring attachment points, it became apparent that there wouldn't be enough balsa to form

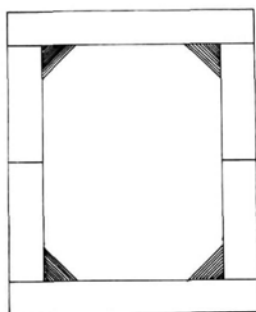


the rounded corners at the firewall or make a solid glue joint at the nose ring. At this point, I added triangular stock to the inside of the cowl to provide the additional material that was necessary to round out the cowl and to add strength. The cross-hatch sections on the drawing represent the triangular stock pieces that were transferred to the previous drawings.

11

One last step before making sawdust (the fun part!). The nose ring will be attached to an 1/8-inch-thick backplate that's fitted with blind nuts to accept machine screws. The backplate is drawn on the wood plan for the nose-ring area.

This engine has a 30mm drive flange, and the opening in the center of the nose ring is 11/8 inches in diameter to provide clearance. The point where the drive flange passes through the

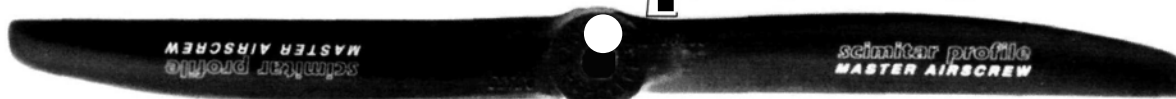


nose-ring backplate, however, is only 20mm in diameter. That's all the clearance needed at the top of the backplate to "drop" the engine into place. The nose-ring backplate, which looks like a horseshoe, is made to fit tightly between the balsa parts of the lower cowl; it must clear the balsa parts of the upper cowl. In a future issue, I'll show you how to build a streamlined cowl using the design techniques outlined here.

That article will be followed by another that will detail the steps involved in covering the cowl.

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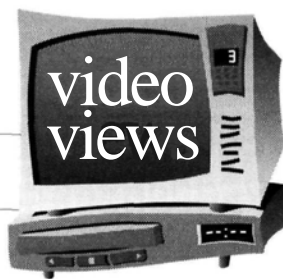
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by JEF RASKIN

## FORMATION FLYING

*Subject: formation flying with piloted craft.*

*Source: Darton Intl. Inc., 2725 Jefferson St., Ste. 7, Carlsbad, CA 92008; (619) 434-0701.*

*Summary: a serious, professional introduction to the topic.*

*List price: \$69.95 (plus S&H).*

*Rating: ★★*

*Approximate length: Vol. 1—57 minutes; Vol. 2—52 minutes.*

Formation flying is a dream of many model airplane pilots, but it's a difficult one to achieve. Our ground-based perspective makes it impossible to judge the spatial relationships of our models, especially in terms of their distance from the pilot. The success that some R/C flying teams have managed comes nowhere close to the magnificent coordination of the full-size piloted planes we try to emulate.

But it isn't easy for our large brethren, either. In hopes of understanding more about the art, I decided to review these highly recommended tapes, which had been given an unabashed thumbs up from Bob Hoover—one of the finest pilots ever to push a stick.

Darton Intl. has produced a beautifully shot and intelligently presented course in two tapes. Aside from the formation information, modelers will enjoy the many air-to-air shots of the T-28s and other planes used as exemplars. A lot of what is covered is not applicable to modelers (such as the cockpit-to-cockpit hand signals and the need for parachutes), but the videos provide a rare and welcome view into the life and work of show-plane and warbird pilots.

Some of the insights are very useful; for example, it's much easier to learn formation flying if the aircraft are identical so that they have the same acceleration, inertia, turn radiuses and the like. Formation flying is an art, but it is also a discipline. There's no room for individuality or hot-dogging. Modelers can

conclude from this tape that if they wish to attempt formation flying, they should build their planes with matching engines, weight, control throws and construction.

Notable quote: "You are never in formation; you are always working to get into formation."

## ELECTRIC-FLIGHT PRIMER

*Title: Getting Started in Electric Flight*

*Subject: electric land planes and seaplanes, equipment and techniques.*

*Source: Model Video Productions, 1222 26th Ave. N.E., Olympia, WA 98506; (800) 789-7886.*

*Summary: a solid, accurate account of the state of electric sport flying.*

*List price: \$29.95 (plus \$3 S&H; Washington residents please add 7.9% tax).*

*Rating: ★★*

*Approximate length: 46 minutes.*

Electric-powered models are no longer the poor cousins of the R/C family. This video shows typical models in what would normally be considered the .40- to .60-size range flying with authority and grace off grass and water in typical sport-flying fashion, including effortless loops from level flight. These are planes that the average modeler who is accustomed to glow engines would be perfectly comfortable with. Besides, there are no starting hassles, the planes stay clean, and electrics are utterly reliable—something to remember as you're rowing out to get that seaplane whose gas motor has quit at idle in the middle of the lake.

Consider the safety factor: the pilot and narrator, Bob Benjamin, approaches the model from the rear. He reaches into the cockpit and turns on the radio without ever getting anywhere near the prop. (It's not shown in the video but, at this point, I always check the operation of my control surfaces.) Then he turns on

the switch that activates the motor. Until that switch is thrown, even accidentally hitting the throttle lever will not start the engine. No ear protection is required. He takes a few steps away with the prop not moving, then he operates the throttle lever and taxis out. If, somehow, the motor had started unexpectedly, it would have taken the plane away from—not toward—him. At no point is he even in the prop arc, should the prop throw a blade or pebble.

The equipment and methods presented are, in my opinion, just what a sport flier should use. For example, peak-detecting battery chargers are recommended over timed chargers, and the importance of fuses and good-quality connectors, such as Sermos or Astro Flight, is explained. Bob insists on top-of-the-line motors, but I have had \$10 can-type motors last for more than 300 flights. If you have the bucks, go with the good stuff, but the others will fly planes.

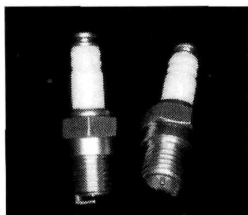
There is a lot of good advice on how to convert glow kits for electric, and a few particular kits that work well are listed. Bob mentions the importance of choosing the right props, and this can't be overemphasized. He recommends Windsor Propeller Co.'s new Master Airscrew props designed especially for electrics. I have tried them and agree completely: they are really different from glow props and are significantly better for electrics.

The video is well-produced and the narration is clear and straightforward. The planes sound a lot louder here than they do in the field—a reversal of what happens when glow engines are recorded. A second volume is in the works, and a broadcast standard master is available for use on the air. •





# PRODUCT NEWS

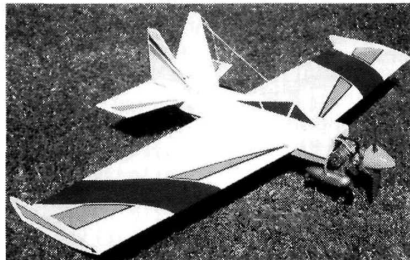


## C&H ELECTRONICS 1/4x32 Spark Plug

This American-made spark plug uses state-of-the-art technology and is made of high-quality materials. Its ground electrode is machined as an integral part of the spark-plug body, so it can be set accurately and won't break off. This precisely made plug won't damage the threads in your cylinder head. Dimensions: thread—1/4x32; hex—5/16 inch; length—1 inch.

**Price**—\$12.95 each (plus S&H; minimum order of two plugs).

**C&H Electronics**, P.O. Box 1732, Riverton, WY 82501; (307) 857-6897.

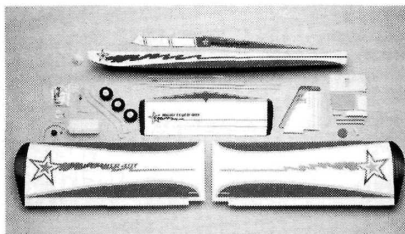


## FIRST STEP R/C The Sidewinder

This easy-to-build kit has foam-core wings, hand-cut lite-ply and balsa parts, and a hardware package that includes formed tricycle landing-gear wire, a motor mount, aileron linkages, hinges, horns and illustrated, step-by-step instructions. The Sidewinder is extremely aerobatic and has good slow-flight performance. Specifications: wingspan—52 inches; wing area—600 square inches; weight—4 pounds; engine required—.40 2-stroke; radio required—4-channel.

**Price**—\$49.95 (plus \$5 S&H).

**First Step R/C**, P.O. Box 40023, Georgetown, TX 78627; (512) 331-2943.



## GLOBAL HOBBY DISTRIBUTORS Right Flyer 40T

This large, lightweight ARF has a light wing loading and a medium to slow speed range and, because it's already built and covered, you can start flying right away. The model has a flat-bottom wing, which provides a stall-resistant, slow final approach, and its tricycle landing gear makes takeoffs, landings and ground handling easier. Specifications: wingspan—64 inches; wing area—736 square inches; engine required—.40 to .46 2-stroke or .60 4-stroke; radio required—4-channel.

**Part no.**—125760; **price**—\$149.99.

**Global Hobby Distributors**, 10725 Ellis Ave., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.



## IKON N'WEST 1/4-Scale Mister Mulligan

High-quality, hand-cut balsa parts and full-size ink drawings make this kit a good choice for average builders who want a fast, scale model. The two wing panels are attached with tubes, bolts and struts, and the tail surfaces are of scale thickness built up to 7/8 inch. The kit comes with aluminum landing gear, a fiberglass cowl and wheel pants, decals and all hardware. Specifications: wingspan—95 inches; length—72 inches; weight—approximately 20 pounds; engine required—ST3000 to G-62.

**Price**—\$455 (plus \$14.50 S&H).

**Ikon N'West**, P.O. Box 306, Post Falls, ID 83854; (800) 327-7198.

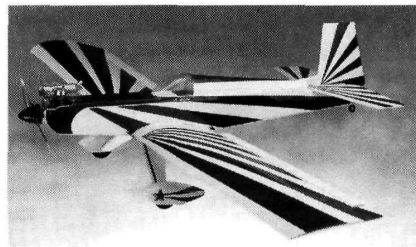


## ALTECH MARKETING F-14 Tamecat

This kit should be ready to cover in less than two hours. It has a light wing loading, a flat-bottom airfoil and a wide chord, and it comes with molded-ABS wingtips, cockpit deck and cowl and a clear molded canopy. Its wide main landing gear provide solid ground tracking, and a single, standard-size servo operates the nose gear and both rudders. Specifications: wingspan—72 1/2 inches; wing area 794 square inches; ready-to-fly weight—6 1/2 pounds; engine required—.40 2-stroke.

**Part no.**—IE800.

**Altech Marketing**, P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.



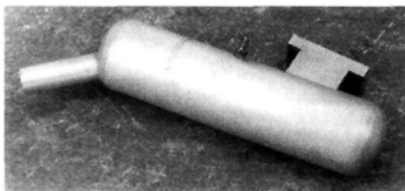
## U.S. AIRCORE INC. Colt 40

This corrugated-plastic model is easy to build and almost indestructible. Just fold the pre-cut parts along the scored lines, glue them together with contact cement, and you're ready to go to the field. For outstanding aerobatic performance, build it with the included Turbo wing. Specifications: wingspan—64 inches (turbo version—58 inches); wing area—704 square inches; wing loading—18.8 ounces per square foot; length—41 inches; weight—5.75 pounds; engine required—.40 to .50 2-stroke or .48 to .53 4-stroke; radio required—4-channel.

**Part no.**—USA2070.

**U.S. AirCore Inc.**, 4576 Claire Chennault, Hangar 7, Dallas, TX 75248; (800)336-0602.

# PRODUCT NEWS

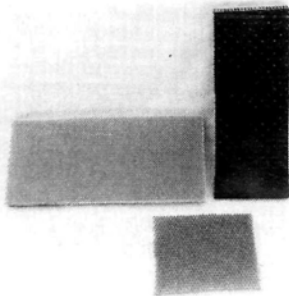


## WEBRA 1.20 Muffler

Made of heavy-gauge aluminum with a "bead-blasted" finish, this bolt-on, high-performance muffler provides superior silencing and back pressure. Its exhaust outlet is aimed away from the model, and its bar-stock-aluminum mounting flange is strong and rigid. The Webra 1.20 also comes with an installed brass nipple.

**Part no.**—WEBE1100120; **price**—\$64.95.

**Webra**; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.



## AEROPLAN INC. Honeycomb Panels

These strong, light, fuelproof panels are available in either fiberglass or carbon-fiber. The easy-to-cut materials come in 3/16i- and 1/2-inch thicknesses. Weight: 3/16-inch-thick panel—2.46 ounces per square foot (fiberglass), 3.5 ounces per square foot (carbon fiber); 1/2-inch-thick panel—3.07 ounces per square foot (fiberglass), 3.93 ounces per square foot (carbon fiber).

**Prices**—\$15/square foot (fiberglass); \$20.50/square foot (carbon fiber).

**Aeroplan Inc.**, 14850 N.W. 44th Ct., Ste. 252, Hangar 102, Opa-Locka Airport, Opa-Locka, FL 33054; (305) 687-0556; fax (305) 687-4438.



## HOBBY SHACK 12V Starters

These starters have high-torque, 12V motors with anti-slip "texture-finish" paint; high-impact, anti-roll glass/nylon endbells; long, heavy-duty, electrical cords with chrome-plated battery clamps; positive-action, anti-slip on/off switches; aluminum starter cones with V-belt grooves; and rubber inserts. You can start any .65 and smaller engine with the Deluxe version; the Heavy-Duty Deluxe starter will work with engines of up to 1.08ci displacement.

**Part nos.**—229470 (Deluxe); 229475 (Heavy-Duty Deluxe); **prices**—\$19.99; \$28.99.

**Hobby Shack**, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (800) 854-8471; fax (714) 962-6452.

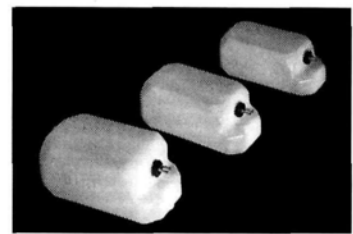


## C-TRONICS INC. Flight Alarm

Plugged into any servo connector, this unit will monitor your flight pack when the receiver is on. If the voltage drops below 4.75, a pulsing alarm (with an intensity of 90dB at 3 feet) will sound. The unit also has a missing-pulse detector circuit that you can use with a standard AM or FM control system to monitor the transmitter signal. Specifications: diameter—1.75 inches; weight—less than 1 ounce; current draw—less than 5 milliamps. The Flight Alarm is available with Futaba, Airtronics, or JR connectors (please specify with order).

**Price**—\$29.95 (NJ residents add 6-percent sales tax).

**C-Tronics Inc.**, P.O. Box 192, Ramsey, NJ 07446; (201) 818-4289.



## DU-BRO PRODUCTS INC. Giant-Size Fuel Tanks

Available in three sizes, these fuel tanks come with fuel stoppers, tubing for glow and gasoline fuel and large, nickel-plated clunks.

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**Du-Bro Products Inc.**, P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (708) 526-1604.



## ICARE SAILPLANES ASW-19

A semi-scale reproduction, this 2-meter model is well-suited to slope flying. The kit comes with a white epoxy/glass fuselage, obechi-sheathed foam wings, routed ailerons, installed push-cable tubes, a clear-plastic canopy, a molded-fiberglass canopy tray, built-up tail surfaces, all wood and hardware, instructions and a CAD building plan. Specifications: wingspan—82 inches; wing area—480 square inches; weight—42 ounces; wing loading—12 ounces per square foot; airfoil—E 203 mod.

**Price**—\$145 (plus \$15 S&H).

**Icare Sailplanes**, Etienne Dorig, 381 Joseph-Huet, Boucherville, Quebec, Canada J4B 2C5; (514) 449-9094.

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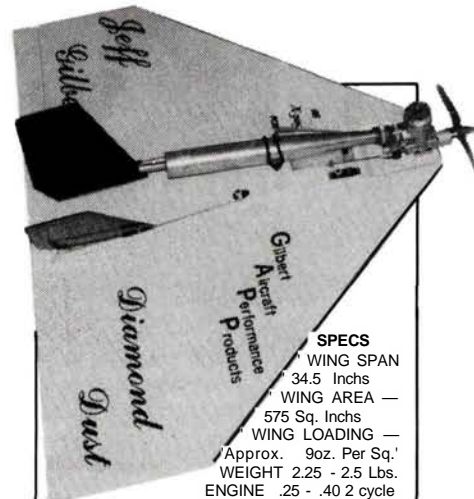
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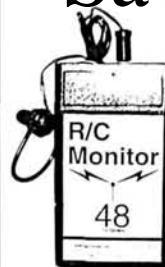


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# NAME THAT PLANE

## CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

CONGRATULATIONS to Bob Upton of Montgomery, TX, for correctly identifying the March 1995 mystery plane. Designed by Ken Stockbarger, the 17-foot, 6-inch-long Shoestring has a 19-foot wingspan. Ray Cote acquired his famous no. 16 Shoestring Formula One racer in 1966 and flew it to victory in several championships.

From 1968 through 1975, Ray Cote won all the Formula One championships with his Shoestring. In '75, he reached a top speed of 227.46 mph. In 1979 he placed second with a record-qualifying speed of 246 mph and, in 1981, became the Formula One champ again with a speed of 232.13 mph.



The Shoestring's Circus Circus paint job wasn't added until the 1978 Reno race when Circus Circus became Ray's sponsor. Ray raced the Shoestring in a clown suit and a crash helmet that had clown hair glued to the outside. Ray's pit crew also wore clown suits. The plane was retired from racing in 1981 and is now on display in the San Diego Air and Space museum.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.

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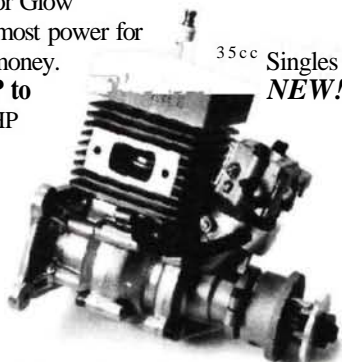
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# CLUB OF THE MONTH



## ROCHESTER AEROMODELING SOCIETY

74 Evangline St., Rochester, NY 14619-2034

When the Rochester Aero-modeling Society (RAMS) gathers, people take notice; more than 500 visitors came to their open house and Macedon field grand opening to see what R/C is all about. In the club's November '94 newsletter, photos of wall-to-wall people and well-built aircraft on the flight line capture the excitement and festivity of the day; it looks as though everyone who was involved enjoyed the weekend celebration. We're sure that more than a few visitors were bitten by the R/C bug!

This is the second field to be maintained by the club, and the newsletter indicates that a pavilion and more than one runway will soon be finished. These accomplishments are the result of a lot of hard work; congratulations.

RAMS newsletter editor Jeff Hamilton writes that, short of flying, one of the most enjoyable things anyone in our hobby can do on a weekday evening is to buy a bargain plane or kit; and the RAMS members did just that at their annual flea market and auction. One modeler's clutter is another modeler's winter project; everybody went home smiling.

RAMS members: for your fine efforts in field ownership and community awareness, we award you two complimentary subscriptions to *Model Airplane News*. Keep up the good work!

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# FINAL APPROACH

## AIR POWER

**A**N UNEXPECTED advance in air power promises to enhance flying prospects for countless backyard R/C modelers for years to come. The new compressed-air engine developed by Frank Vassallo keeps a 1-pound R/C aircraft aloft for about 21/2 to 3 minutes in no-lift conditions. A 4-liter reservoir of compressed air charged to 120psi spins Frank's custom-built 14x18 prop at over 2,000rpm for the first 10 seconds. The 30-degree climb-out of Frank's current prototype tops out above 300 feet. In 60 seconds, the prop slows to 1,000rpm, and in 20 more, it dwindles to around 750.

Since 1991, Frank has designed and built 40 to 50 such engines, constantly testing his ideas and improving performance (as many readers may recognize, he has also contributed to Dave Gierke's "RPM" column in the past). One of his innovations is an auxiliary air reservoir, or plenum, that surrounds the cylinder head. The reservoir increases the engine's efficiency by metering airflow to the piston and reducing compression on the return stroke.

When the piston is at top dead center, it opens a poppet valve to the source tank; this allows

air to flow into the reservoir and to the piston. Air flows from the reservoir to the piston head as the piston sweeps downward toward bottom dead center and the exhaust phase. Because airflow to the piston head is metered by the plumbing between the

plenum, the piston and the source tank, the closing of the source-tank poppet valve is slightly delayed. This contributes to a longer stroke actuation.

As the piston starts its upward return, the extra volume in the reservoir decreases the re-compression that could otherwise kick the piston back. In lesser designs, this backpressure can reverse engine direction, break a conrod, or otherwise contribute to balky performance. Because there is less compression, the air stays cooler and is used more efficiently.



**The new, patented Vassallo engine, disassembled. The aluminum, brass and plastic twin weighs 80 grams (about 2.8 ounces) without the prop.**



**Frank launches an early prototype air-powered airplane called the "Fan-To-See."**



**Note the handcrafted propeller. Frank's measurements indicate that he is achieving about 500 to 600 inch-pounds of work per gram of air running through the engine. (This is very efficient; a shop air motor for tightening bolts typically generates about 350 inch-pounds of work per gram.) The engine runs very quietly.**

Frank's most recent design (see engine photos) is a twin with no offset. The conrods, made of 3/32-inch brass stock, are flattened to a still narrower 0.040 to 0.050 inch where they are attached to the crankpin. No wristpins here; the conrods' ball tips nest in sockets under the pistons, which are held in place by positive pressure. O-rings seal the pistons and other key junctures. They have shown no appreciable wear after 50 flights, but the whole setup allows easy replacement as well as lubrication. Greasing the skids provides an efficiency improvement of a few percent.

Frank, a mechanical engineer who has worked extensively in thermodynamics, avionics, hypersonic flight and other disciplines at Calspan Corp., in Buffalo, NY, for nearly four decades, will make the engine available to modelers in late '95. The very first

engines—all handcrafted, custom-built gems—will probably retail in the \$125 to \$150 range, but price is expected to drop as volume increases. We will give you a full report on the new engine and the aircraft designed for it in a future issue. Stay tuned.

—Tom Atwood

**Frank holds the Baromaster, his latest aircraft design for his compressed-air, twin engine. Spinning a 14x18 prop at 2,000rpm on the bench, the system delivers about 10.6 ounces of thrust (with a calculated torque of 20 oz.-in.). Air tanks are refitted soda-water containers wrapped in Kevlar and charged to 120psi. The airplane, which flies at a leisurely 17mph, is controlled by a 2-channel Cannon micro system that uses a 75mAh battery.**